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Monterey, California

THESIS

ALLOCATION METHODS FOR USE IN THE ACCRUAL OF MANPOWER COSTS

by

Steven G. Waterman

June 1983

Thesis Co-Advisor: K. J. Euske
G. W. Thomas

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Allocation Methods for use in the Accrual of Manpower Costs

by

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Commander, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

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ABSTRACT

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I. BACKGROUND

A. HISTORY OF NON-DISABILITY RETIRED PAY

The first major non-disability retirement act dates back to August of 1861. This Act provided for the voluntary retirement of regular officers of all branches of the service, at the discretion of the President, after they served 40 years of duty. In 1870, for Army and Marine Corps officers, and 1873 for Navy officers, Congress established voluntary retirement for officers after 30 years of service upon approval of the President and set retired pay at 75 percent of pay of the officers grade at time of retirement.

The first non-disability retirement act for enlisted personnel in the Army and Marine Corps was enacted in 1885. This law authorized voluntary retirement after 30 years of service and fixed retired pay at 75 percent of pay of the grade in which retired plus an allowance in lieu of quarters, fuel and light. The Navy enlisted personnel received this same entitlement in 1899.

In 1916 two new principles for the non-disability retirement system were enacted. The first established an up-or-out selective promotion plan with selection boards for promotion to Commander, Captain, and Rear Admiral on the basis of age-in-grade. A Captain who failed to be selected for promotion by the time he reached age 56, or a Commander by age 50, or a Lieutenant Commander by age 45, became ineligible for further

consideration and had to be retired. The second principle enacted in 1916 was the use of the 2.5 percent formula for retirement compensation. This principle provided that officers who were retired for failure to be promoted were entitled to retired pay of 2.5 percent of the shore duty pay for his grade for each year of service up to a maximum of 30 years.

Congress changed the voluntary retirement provisions for Navy and Marine Corps officers in 1938 to allow for retirement after 20 years of service at the discretion of the President. Retired pay was computed by the standard 2.5 percent formula, not to exceed 75 percent of pay. It was not until ten years later, when the Army and Air Force Vitalization and Retirement Equalization Act of 1948 established 20 years as the minimum requirement for voluntary retirement, that the Army and Air Force were put on a par with the Navy and Marine Corps. This law resulted, for the first time in history, in uniform voluntary retirement authority for officers of all branches of the service (DOD, 1976; DOD, 1981).

B. THE PRESENT RETIREMENT PROVISIONS

Today's military retirement system is a defined benefit system which authorizes voluntary non-disability retirement after 20 years of active military service, subject to the approval of the Service Secretary. The retiree receives 2.5 percent of active duty base pay for each year of service up to a ceiling of 75 percent of base pay. For the retiree who first became a member of the military before 8 September 1980

final basic pay is used to compute retired pay. For those who became members on or after that date base pay for retired pay computation is equal to the average of the member's highest 36 months of basic pay (DOD, 1976; DOD, 1979; AEILA, 1980).

The plan also takes into account annual changes for inflation through cost-of-living adjustments that are tied to the consumer price index. The adjustment, which becomes effective annually on March 1st, is computed by calculating the percentage increase (adjusted to the nearest 1/10 of one percent) between the two previous December consumer price indexes. The revised CPI for Urban Wage Earners and Clerical Workers is used for determining the military retirement cost-of-living increase (DOD, 1981).

C. PURPOSE OF RETIRED PAY

The military retirement system plays a major role in the military's manpower management program. As a part of the management plan, it serves as an integral part of the compensation package which is designed to help attract and retain qualified personnel in the service (DOD, July 1982). The military retirement system is not merely an old age pension plan but is designed to complement the personnel management requirements of the Armed Forces and to help maintain a strong and ready force (AEILA, 1980). A purpose of the early voluntary retirement provision (20 year retirements) is to keep the force young and to reward those who have successfully completed 20 years of military service. Those who do retire are not retired in the traditional sense of the word, but are retained

in a military status being subject to the Uniformed Code of Military Justice and subject to recall to active duty (DOD, 1981).

The purpose of military retired pay is set forth by the Department of Defense in its Military Compensation Background Papers (1982). Their stated reasons for today's non-disability retirement system are: (1) to insure that the choice of career service in the military is competitive with private sector alternatives, (2) to insure that promotion opportunities are kept open for young and able members, (3) to insure a measure of economic security for military personnel after retirement from active service, and (4) to insure a pool of experienced personnel subject to recall to active duty during time of war or national emergency exists.

D. ACCOUNTING BASIS

The accounting basis used for allocating retired pay costs to a period or periods of time can either be cash basis or accrual basis of accounting (Hicks, 1965). Accrual basis is the method of accounting by which revenues and expenses are measured and reported in the period in which they are incurred without regard to the date that they are paid. In contrast, cash basis is the method of accounting whereby revenue and expense recognition depends solely on the timing of cash receipts and disbursements without regard to the period to which they apply (Welsch and Anthony, 1981).

Throughout the history of the military retirement system, retired costs have been financed on a pay-as-you-go basis with funds for current year payments being appropriated annually (AEILA, 1980). Pay-as-you-go financing is the same as cash, basis accounting because expenses are not recognized when incurred but when the payment is due. Under the present cash basis of accounting, the retired pay expense that is recognized in any specific year is the amount that is actually paid to those members who receive retired pay in that year (Munnell, 1979).

For fiscal year 1981 1.1 million non-disability retirees received retired appropriation outlays totalling $12.5 billion. The average monthly gross receipt for all non-disabled officers was $1,751 and $761 a month for non-disabled enlisted retirees (DOD, 1981).

With retired pay being budgeted on a past-services basis, the retirement costs of military personnel often do not appear in the budget until many years later when the member actually retires from active service. The fallacy with this procedure is that it does not adequately recognize the future cost of the present force (Canby, 1972). In accessing the disadvantages of the pay-as-you-go method of accounting, the Congressional Budget Office (1977) stated:

> Under the present accounting system, the defense function includes retirement costs of former military employees who do not contribute to today's defense, but it includes no charges at all for current military employees who are participating in today's defense (p. 13).

Anthony and Herzinger (1980) further point out that:

> Failure to record pension costs in the year in which they are incurred is one of the most serious weaknesses in State and Local government accounting systems (p. 196).

This applies to the military retirement system as well. Omitting retired pay not only understates the costs of the current military force, but it also puts the burden of paying for retired costs on future generations, rather than on the current generation which receives the benefit of the Armed Forces. In order to recognize the total cost of retired pay to the taxpayer a method of allocation must be used to distribute the cost of retirement over the members years of active service (Professional Standards, 1975). Without this

> . . .the DOD, it is claimed, has no incentive to consider the retirement costs that will result from decisions concerning today's manpower requirements (AEILA, 1980, p. 3).

Along with being budgeted and paid for on a yearly basis, the military retirement plan also has the characteristics of being a non-funded and non-contributory defined benefit pension plan. The main features of these characteristics are discussed:

1. Non-Funded. A non-funded plan is one in which no cash reserve is set aside to meet retirement benefit obligations when they become due. As retired pay obligations become payable, they are paid out of current year appropriations (Greenough and King, 1976).

A funded plan is one in which assets are accumulated for the purpose of meeting retirement benefits when they become due (Hicks, 1965). The funding of private pension plans is a requirement established by the Employee Retirement Income

Security Act (ERISA) of 1974. Minimum funding standards are set for defined benefit plans for the primary purpose of insuring the plan's present and future ability to pay the benefits when due (Matz and Usry, 1980). Private pension plans have a need to accumulate funds to pay retirement benefits since they do not have the power to tax or the security of continued existence. In contrast, it has been argued (DOD, 1976) that the Federal Government with its power to tax, does not have to accumulate funds to insure that benefits will be available to retirees at a future date.

If the Federal Government were to adopt funding practices for their retirement program accumulation of reserves would not necessarily follow. Munnell(1979) contends that unless taxes are increased or total expenditures decreased by the amount needed to fund payments, the funding practice would be nothing more than a paper transaction between the Treasury and the military retirement fund.

2. Non-contributory. A non-contributory plan is one in which the employee makes no contribution to the pension fund. Since its inception, the military retirement system has been non-contributory. The Military Compensation Background Papers (1976) list four reasons for contributions by employees: (1) Lower direct costs to employer; (2) Possibility that a higher level of benefit will derive if the cost is shared by the employee; (3) A greater appreciation of the benefits of the plan by the employees if they share in the costs;

(4) A perception by the employees that they have a contractual right to their pension if they help pay for it.

Three major studies have dealt with the issue of whether the military retirement system should remain non-contributory. The Hook Commission in 1948, and a Study Committee of the University of Michigan in 1961, recommended that a contributory plan for the military retirement system should not be adopted. The third study, The First Quadrennial Review of Military Compensation, recommended in 1967 that a retirement contribution should be collected from military personnel (DOD, 1976).

The Hook Commission in its recommendation stated that the non-contributory plan had been traditional in the military and was particularly suited to a Government agency. They argued that if a contributory plan was adopted it would require increased expense to administer the program and little if any actual savings would be realized through military contributions (DOD, 1976).

The University of Michigan Study Committee concluded that: (1) under an pension plan employee contributions traditionally make up only a small portion of the retirement benefit costs; (2) where contributory plans are used, pay raises to cover part or all of the contribution are quite often given to off-set any reduction in take-home pay caused by the plan; (3) administrative costs associated with running an enormous number of savings to bank accounts would off-set, or possibly even overwhelm, any savings. For these reasons, the Committee recommended against contributions by military members (DOD, 1976).

The First Quadrennial Review of Military Compensation in recommending in favor of a contributory plan concluded that, under the present system, military personnel are making an implicit contribution to their retirement through the vehicle of reduced basic pay rates in lieu of direct contributions. The review argued that this imputed contribution is inequitable to those members who do not serve to retirement. Through an explicit contribution plan the member who terminates service prior to retirement could collect his portion of the contribution (DOD, 1976).

3. Defined Benefit Plan. Most pension plans are either defined benefit plans or defined contribution plans. A defined benefit plan determines in advance the amount of pension benefit an employee will receive when he retires. The amount contributed to the fund varies. A defined contribution plan has a fixed contribution amount but the actual amount of benefits the employee receives at retirement is not known. The amount received at retirement is determined by the money that has accumulated in the employees account at retirement (DOL, 1979).

The military retirement system is a defined benefit plan in that benefits derived from the plan are predetermined and guaranteed to the retiree. Each service member who remains on active duty for 20 years knows that his retired pay will be equal to 2.5 percent of his base pay for each year of service up to a maximum of 75 percent of base pay (Greenough and King, 1976).

E. OBJECTIVE

The objective of this thesis is to evaluate alternative methods for allocating military retired pay costs. Primarily, it will look at how non-disability retirement costs should be allocated so that they reflect the full cost to the taxpayer associated with defense manpower decisions.

In recent years the issue of the military's pay-as-you-go basis of accounting for retirement costs has been addressed by the Congressional Budget Office and the General Accounting Office (AEILA, 1980). There is growing support for changing the method of accounting for retired pay from pay-as-you-go basis to accrual basis so that the full cost of military manpower decisions will be apparent to the Administration. It is felt that this increased visibility of the cost of retirement benefits might make defense planners more frugal in their use of military manpower (CBO, 1978).

Generally Accepted Accounting Principles (GAAP) recognize accrual basis accounting as the only fair presentation of pension costs in financial statements (Hicks, 1965). Therefore, in accessing allocation methods, private and public sector handling of pension costs under accrual basis accounting will be studied to determine their applicability to the military retirement system.

Ultimately, the author's goal is to recommend an allocation method to be used in accounting for the cost of the military retirement system.

II. ALLOCATION BASIS

A. INTRODUCTION

Chapter II provides a discussion of some basic concepts and ideas associated with cost allocation. The allocation problem is initially discussed in Section B from a theoretical view point followed by a discussion in Section C as to why indirect costs are allocated even though there is no theoretical justification for it. Conventional methods for allocating costs under accrual basis accounting are presented in Section D. Section E presents the reader with the Accounting Principle Board's position on the use of accrual basis in accounting for pension costs. The board supports the use of actuarial cost methods in handling pension costs and Section F presents the reader with some basic terminology and characteristics of actuarial cost methods. Section G through K discuss separately the unit credit, entry age normal, individual level premium, aggregate and attained age normal actuarial cost methods for accounting for pension costs.

B. ALLOCATION THEORY

In discussing allocation theory one must first define what the word theory represents when applied to accounting. Hendriksen (1970) states:

> . . .accounting theory may be defined as logical reasoning in the form of a set of broad principles that (1) provide a general frame of reference by which accounting practice can be evaluated and (2) guide the development of new practices and procedures. (p. 1).

Allocation is the assignment of costs of individual inputs or groups of inputs to the firm including the assignment to individual periods of time, divisions, and products. In looking at methods of allocation two types of costs must be considered: direct costs and indirect costs. Direct costs are those costs which can be identified directly with a cost objective, i.e., a department, function, or activity. Conversely, indirect costs are those costs which cannot be identified with a single cost objective, but which are incurred for the benefit of more than one department, function, or activity (Matz and Usry, 1980).

The allocation of direct costs is straight forward. Since there is a demonstrable and immediate relationship between the cost and cost objective, the cost is directly applied to that objective. As an example, salary paid to a welder in an automobile factory is a direct cost which may be assigned by direct application to that production department (Beckett, 1951). In contrast, the relationship of indirect costs to the cost objective is not as easily determined and as a result, the allocation of indirect costs is one of the most controversial practices in accounting (Fremgen and Liao, 1981). A method used for the allocation of indirect costs employs the approach of accumulating indirect costs in cost pools and then allocating these costs to cost objectives on the basis of benefit. An example of this type of allocation is the accumulation of lighting and heating costs in a common pool and then allocating these costs to departments on the basis of the square footage

occupied by individual departments (Beckett, 1951). In practice, this type of allocation of indirect costs is widely used, however, many authors question the validity of any indirect cost allocations at all. Thomas (1976) maintains that in order for an indirect cost allocation method to be justifiable it must meet the following minimum requirements:

1. The method used should be unambiguous. It should provide clear instructions, in advance, as to how the allocation should be applied.

2. The method should be defendable. To be defendable, it should be demonstrated that a particular allocation method is better than all other possible alternatives. For instance, in financial accounting whatever approach that one adopts for allocation there usually will be a variety of conflicting alternative methods, all of which appear to be consistent with what one is trying to accomplish. However, at present there seems to be no way of conclusively defending one choice over the other.

3. The allocation should be additive. The method used should divide up the total of what is available, no more or no less.

In discussing allocation Thomas further contends that almost all allocations presently made are arbitrary and incorrigible and no solution to the problem is possible within the present framework of allocation theory or conventional rules. They are considered to be arbitrary because they are

made on the basis of someone's opinion as to how they should be apportioned and not on the basis of theoretical evidence. They are incorrigible because it is impossible to prove that they are either correct or incorrect (Thomas, 1974).

In allocating indirect costs over time different schemes may be used in apportioning costs to individual years, i.e., level portions, decreasing portions, or increasing portions. The appropriateness of the allocation method used in matching the cost with the benefit depends on the judgement of the people selecting the allocation method. The most that can be expected from such an allocation basis is that it is intuitively reasonable. Unfortunately, reasonable people may make different judgements on any given allocation and therefore there is no basis for defending the method of allocation selected (Fremgen and Liao, 1981).

It can be concluded from Thomas' studies that there is no theoretical justification for allocation of indirect costs over time. However, it is not necessarily wrong to make arbitrary allocations as long as the allocations are not treated as being theoretically justified. Accountants should explicitly acknowledge that all allocations are arbitrarily made and thus respond in an appropriate way to this awareness (Thomas, 1976).

C. WHY ALLOCATE?

If allocations cannot be justified on a theoretical basis, then why do accountants allocate indirect costs? So far as

the accounting procedures are concerned, indirect cost allocations are made in practice because management preceives a need for them (Fremgen and Liao, 1981).

Thomas (1971) concedes that there are circumstances in which allocations of indirect costs may be useful to users of accounting data even though the allocations are arbitrarily made. Two categories of allocations which Thomas feels that are totally ambiguous and theoretically unjustified, yet which perhaps may be useful to an entity, are:

1. Allocations which are required by laws, regulations, and customs. Allocations of these types become automatically useful in that they satisfy a requirement.

2. Mutually satisfactory allocations. In this type of allocation the common cause of two or more entities are served.

Fremgen and Liao (1981) suggest four possible reasons for which indirect cost allocations may be useful. These reasons are:

1. Financial Reporting. For financial reporting the primary purpose for allocating indirect costs is to insure a realistic valuation of inventories, and therefore a realistic measurement of profits.

2. Planning and Decision Making. Cost allocation assists the decision maker in determining what costs will be in the future as a result of decisions made today.

3. Pricing. Cost allocations are used to set appropriate selling prices. For this purpose, allocation is important in

that it makes the product bear its share of indirect costs which management feels is necessary to warrant continuation of the product line in the long run.

4. Control and Performance Evaluation. Cost allocations are made for the purpose of influencing the managers behavior with respect to costs by assigning them responsibility for a portion of the cost. The usefulness of cost allocations as a tool for controlling and evaluating performance is a controversial issue. Some writers maintain that it is effective and others argue that it has a detrimental effect. Demski (1976) suggests that when cost allocations are used for control and performance evaluations one must be careful to ensure that the manager is only held responsible for those aspects of performance that he has control over. He should not be evaluated on the basis of outcomes which are influenced by outside factors that he has no control over nor on results that are influenced by the actions of other managers. Evaluations that are based on noncontrollable aspects may prove to be dysfunctional instead of providing the desired motivation to improve performance. Therefore, care should be taken in deciding on what is or is not controllable by the manager.

The American Institute of Certified Public Accountants (AICPA) supports the allocation of indirect costs stating that if a benefit is provided for more than one period, then its costs should be allocated to the periods in a systematic and rational manner. Since the allocation always involves

assumptions about the relationship between costs and benefits, the method selected for use should appear reasonable to an unbiased observer (Professional Standards, 1975).

In summary, allocation of indirect costs continues to be employed by accountants because it fulfills a need (actual or perceived) for assigning costs to cost objectives or periods of time.

D. CONVENTIONAL ALLOCATION METHODS

Cost allocation is fundamentally a problem of linking some cost or groups of costs with cost objectives within a period or with time periods. Linking costs with cost objectives within a period entails allocating costs to products, departments, and segments of a firm. Types of costs allocated in this manner are factory overhead costs, service center costs, and general and administrative costs (Fremgen and Liao, 1981). The allocation of costs among cost objectives within a period is used in cost accounting for the four purposes discussed in the preceding section; financial reporting, planning and decision making, pricing, and control and performance evaluation. Allocation of costs to cost objectives within time periods is not considered any further in this study.

The second type of allocation, the linking of costs with cost objectives among time periods, is simply the spreading of costs over time. Examples of this type of allocation are depreciation or amortization of long term assets (Fremgen and Liao, 1981). It is this second concept of allocation which plays a major role in accrual basis accounting and that is used in the allocation of pension costs.

Allocation of costs under accrual basis accounting involves matching expenses as closely as possible with revenue. Expenses are the costs that are associated with the revenue of the period. Costs which are associated with future revenue or otherwise linked to future accounting periods are deferred to future periods as assets. Costs which are associated with past revenue or otherwise linked with past accounting periods are treated as adjustments of expenses of those periods (Professional Standards, 1975). Three expense recognition principles used for recognizing expenses as costs are set forth in APB Statement No. 4:

1. Associating cause and effect. Under this principle costs are recognized as expenses on the basis of a presumed direct association with specific revenue.

2. Systematic and rational allocation. This principle sets forth that if benefits are realized for several periods then its cost should be allocated to the periods in a systematic and rational manner in the absence of a more direct basis for associating cause and effect.

3. Immediate recognition. Under this principle costs are recognized as expenses in the current accounting period because (a) costs incurred provide no discernable benefit to the future, (b) costs incurred in prior periods no longer provide discernable benefit, or (c) allocating costs on the basis of cause and effect or among several accounting periods serves no useful purpose.

In applying the expense recognition principles costs are first analyzed to see whether they are associated with revenue

on the basis of cause and effect. If not, then allocation is attempted through systematic and rational means. Finally, if neither cause and effect nor systematic and rational allocations can be made, then costs are recognized as expenses in the period in which they are incurred (Professional Standards, 1975).

E. THE ALLOCATION OF PENSION COSTS

The total cost of providing retirement benefits to employees is recognized as an expense of operating the business. The assignment of these costs to periods is considered to be a major problem of accounting for the cost of pensions. The use of accrual basis accounting in allocating these costs is strongly supported by the AICPA. In Accounting Research Study No. 8 the Accounting Principles Board states:

> It is a conclusion of this study that an employer's financial position and results of operations, to the extent affected by the cost of a pension plan, are fairly presented only if such cost is stated on the accrual basis (p. 38).

In arriving at this conclusion the following arguments were set forth:

1. Pension plans play a major role in an employer's ability to obtain and retain quality employees. It is considered a part of compensation in the form of deferred retirement payments and as such its costs should be charged to current periods when incurred, not future periods when paid.

2. Even if pensions were not considered as part of compensation, it still is an employment cost which should be accounted for when incurred, not when paid.

3. Employers may properly contribute more to pension funds during good years and less during lean years. By accounting for pension costs on the basis of the amount paid to the fund instead of on the accrual basis yearly expenses can be manipulated to alter net income significantly.

4. Under the consistency concept, pension costs should be derived in the same manner from year to year and should not be arbitrarily determined on the basis of how well the firm's financial position was for the year.

Under accrual basis accounting, the process of allocating pension costs to periods is similar to the handling of depreciation of machinery and equipment except that the cost of depreciable assets are determined by current or past transactions and prices, while pension costs are measured in terms of expected cash outlays in the future (Hendricksen, 1970). The total cost of pension plans to be allocated is measured in terms of expected cash outlays in the future. These costs are somewhat uncertain in that the amount to be paid depends on several future events such as; the employee leaving the firm before retirement or vesting, the employee dying before retirement, and how long the employee lives after retirement. Actuarial methods can generally be used to resolve these uncertainties and therefore pension costs are usually computed by an actuary (Hendricksen, 1970).

Currently, actuarial cost methods are the acceptable means of allocating pension costs under accrual basis accounting.

Pay-as-you-go and terminal funding methods are unacceptable because they do not recognize pension costs until the employees actually retire (Hicks, 1965). The actuarial cost method used for determining pension costs for accounting purposes must be rationally and systematically applied, on a consistent basis, so that it results in a reasonable measure of pension costs from year to year (Professional Standards, 1975).

F. ACTUARIAL COST METHODS

A number of actuarial cost methods (also called funding methods) have been developed for accounting for pension costs. The Accounting Principles Board in Accounting Research Study No. 8 explicitly endorsed the following actuarial cost methods; the accrual benefit (or unit cost) method, the entry age normal method, the individual level premium method, the aggregate method and the attained age normal method. Most of these methods were designed primarily as funding techniques but they also may be used in determining pension costs for accounting purposes. The major characteristics of each of these methods will be discussed separately in later sections.

In selecting the actuarial cost method to be used one should keep in mind that the cost method selected should result in a systematic and rational allocation of the total cost of pensions among the employees' years of active service (Phoenix and Bosse, August 1967). Additionally, for any given actuarial cost method employed, the actuarial determinations of pension costs are necessarily estimates since the actuary must make many

assumptions about future events. These assumptions are called actuarial assumptions (Hicks, 1965). Dreher (1967) lists the following actuarial assumptions as the most frequently used in the valuation basis of a pension plan:

1. The expected rate of return on present and future investments. The assumed rate can have a major impact on the present value of the fund. A ½ percent actual variation from the assumed interest rate can have as much as a 10 to 15 percent change in pension cost accrual in later years.

2. Expected future compensation levels of employees. The actuary makes an estimate of the normal increases expected from the employee's movement through the various earning-rate categories, based on the employee's experience.

3. Mortality of employees both before and after retirement. These estimates are based on mortality tables.

4. The expected retirement age of the employee.

5. The number of employees who will withdraw from the plan before becoming eligible for vesting or retirement.

In practice, actuarial assumptions do not change a pension plan's ultimate cost, but they do have an important effect on current estimates of pension costs. Therefore, the selection of the particular set of assumptions to be used should be based on the facts and circumstances of each pension plan and employee group. Within the same pension plan, it is not unusual to use different assumptions for subgroups of the organization. As

an example, the assumed mortality rates, turnover rates, and salary scales may differ between military officers and enlisted personnel (Dreher, 1967).

Before examining the various actuarial methods available some key terminology are discussed:

Accrued Actuarial Liability. That portion, as determined by a particular actuarial cost method, of the actuarial present value of pension plan benefits and expenses which is not provided for by future normal costs.

Actuarial Cost Method. A particular technique for determining the amount and incidence of annual pension plan benefits and expenses and for developing an actuarially equivalent allocation of such values to time periods.

Actuarial Gains or Losses. A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions.

Actuarial Present Value. The present value of an amount or series of amounts payable or receivable in the future. The present value is determined by discounting the future amount or amounts at a predetermined rate of interest as set by a particular set of actuarial assumptions.

Actuarial Value of Assets. The value of cash investments and other property belonging to a pension fund.

Normal Cost. It is the annual pension cost assigned to years subsequent to the inception of the pension plan or a change in the plan.

Past Service Cost. The pension cost assigned to years prior to the inception of the pension plan.

Prior Service Cost. When there is a change in the plan, it is the portion of the cost assigned to prior years (including any remaining past service cost).

Unfunded Accrued Actuarial Liability. The difference between actuarial accrued liability and actuarial value of assets.

Valuation. The process used by an actuary to estimate the present value of benefits to be paid under a pension plan. It calculates the amount of employer contributions or accounting charges for pension cost. (Hicks, 1965; FASB, 1980; Professional Standard, 1975; Hendrickson, 1970; NCGA, 1982).

G. UNIT CREDIT ACTUARIAL COST METHOD

Under the unit credit actuarial cost method future pension benefits based on service after the inception of a plan are funded as they accrue. This method is referred to as an accrued benefit cost method since it recognizes the costs of benefits only when they have accrued. The normal cost, as determined under this plan for a given year, is the present value of the units of future benefit credited to an employee for that year's service (Professional Standards, 1975).

The past service cost under the unit cost method is determined and treated separately. Its cost is the present value at the plan's inception date of the units of future benefit credited to employees on the basis of service prior to the date of inception of the pension plan (Hicks, 1965).

There are differing viewpoints as to how past service costs should be handled. Some believe that past service costs should be amortized in equal annual amounts (including interest) over a period of at least 15 years, but not more than 40 years (Dreher, 1967). Others believe that if the pension plan is expected to continue in existence indefinitely, then there is no need to provide for anything more than interest on unfunded past service costs. Those supporting the latter approach contend that the annual normal cost contribution plus interest on the past service cost will eventually accumulate assets that will be equal to the actuarial value of all accrued benefits and therefore the security of the employee's pension expectations will be satisfied (Dreher, 1967). The Accounting Principles Board concluded that either approach is acceptable. As a result any period may be selected for amortization of past service cost as long as the total annual provision falls between a minimum and maximum allowable amount. The minimum amount is the normal cost plus interest on the unfunded past service cost. The maximum amount is the normal cost plus 10 percent of the past service cost plus interest on the unfunded past service cost (Phoenix and Bosse, August 1967).

For normal costs, an amount is determined and contributed each year for each individual employee to provide for the benefits attributable to that year's employment service. For the individual employee, the annual normal cost for an equal unit of benefit increases each year because as the period to

retirement shortens, contributions to a fund have a shorter period to produce income, employee earnings generally tend to increase, and the probability of reaching retirement increases. However, the combined cost of all employees tends to change only as the average characteristics of the entire work force change since older employees who generate the highest annual cost are continually replaced by new employees who generate the lowest cost (Ganner and Kingsbery,1966). For a mature work force, the normal cost for the entire group tends to be the same from year to year (Hicks, 1965).

Under the unit credit actuarial cost method as well as with the projected benefit cost methods, actuarial gains and losses arise from changes in the assumptions concerning future events used in pension cost estimates. The actuarial gain or loss is determined by taking the difference between the actuarial assumptions and the actual results. In dealing with these gains and losses the main concern is with the timing of their recognition as a pension cost (Phoenix and Bosse, October 1967).

Three alternative methods of handling actuarial gains and losses have been used: immediate recognition, spreading and averaging. The immediate recognition method is not ordinarily used when dealing with losses, but is used for applying net gains. Under this method, net gains are used to reduce the pension cost in the year of occurrence or the following year. As a result, pension costs may sometimes be substantially reduced or even completely eliminated for one or more years.

Under the spreading method, annual actuarial gains and losses are applied to both current and future costs over a period of 10 to 20 years. As an example, a $5000 gain could be spread over 10 years by applying $500 to the current year and deferring $4500 to future years. The averaging method involves taking an average of annual gains and losses for a pre-determined number of years and applying that sum to the current year. As an example, during a five year period gains and losses were as follows: $1000, $4000, ($2000), $3000, and $5000. The sum for the five years, $11,000, divided by the number of years, 5, results in $2200 to be applied to the current year. The remaining $2800 ($5000 minus $2200) of the current year's gain would be deferred to future years (Professional Standards, 1975).

Under the unit credit cost method actuarial gains are normally recognized on the immediate basis because the Internal Revenue Service requires that these gains be used to reduce the maximum pension cost deduction for the year following the determination. Actuarial losses under this method are normally added to unfunded past service cost.

The unit credit cost method is almost always used when annuity contracts, trusteed plans, or deposit administration contracts are the funding instrument and the benefits are a stated amount per year of service. The method is seldom used when the benefit is a fixed amount or when the current year's benefit depend on earnings of a future period (Professional Standards, 1975).

H. ENTRY AGE NORMAL METHOD

The entry age normal along with the individual level premium, aggregate, and attained age normal, are the commonly recognized projected benefit cost methods. In contrast to the accrued benefit cost method (unit credit method), the projected benefit cost methods look forward. Projected benefit cost methods assign the entire cost of an employee's projected benefits to past, present and future periods without regard to the period during which the service on which the benefits are based has been or will be rendered (Professional Standards, 1975).

Under the entry age normal method, the assumption is made that (1) every employee entered the plan at the time that individual started work or at the earliest time that the individual would have been eligible if the plan had then been in existence, and (2) contributions have been made on this basis from the entry age to the date of the actuarial valuation (Hicks, 1965).

The contributions are level annual amounts which, if accumulated at the rate of interest used in actuarial valuation, would result in sufficient funds being available at an employee's retirement date to provide for the pension in full. The normal cost under this method represents the level amount to be contributed for each year (Hicks, 1965).

Past service cost evolves when the plan is established after the company has been in existence for some time. Under

the entry age normal method, past service cost at the plan's inception date is the theoretical amount that would have been accumulated in the fund had yearly contributions equal to the normal cost been made in prior years. In years succeeding the plans inception, past service cost is usually frozen, that is, the unfunded amount of such cost is changed only to recognize payments and the accrual of interest. Actuarial gains and losses are therefore spread only to the future by becoming part of the normal cost for future years (Professional Standards, 1975).

The total annual contribution under the entry age normal method is normally made up of the normal cost and an amount for past service cost. The past service cost may be comprised of an amount equal to interest on the unfunded balance or it may include interest plus amortization of principle. The considerations in determining the past service payment are basically the same as those used for the unit credit actuarial cost method. The entry age normal method is commonly used when a trust agreement or deposit administration contract is the funding instrument (Hicks, 1965).

I. INDIVIDUAL LEVEL PREMIUM METHOD

Under the individual level premium method the entire cost of each individual employee's pension is assigned in annual level amounts, or as a level percentage of the employee's compensation, from the date of entry of that employee into the

plan (or, for a new plan, from the inception date) to retirement. No past service liability is determined separately, however, since this cost is included in the normal cost the initial annual cost may be very high. The reason for the high initial cost is due to past service cost for employees, who are close to retirement at the inception of the plan, being in effect spread over a short period. The annual cost ultimately drops to the level of the normal cost determined under the entry age normal plan (Hicks, 1965).

The individual level premium method is used most often when individual insurance or annuity policies are the funding instrument. Actuarial losses are not normally recognized under this method since premiums paid are not ordinarily subject to retroactive increases. Actuarial gains are normally passed on to the employer in the form of reduced premiums for the next period (Professional Standards, 1975).

J. AGGREGATE METHOD

The aggregate method is basically the same as the individual level premium method except it is applied on a collective basis. The entire cost of future pension benefits, including benefits to be paid to employees who have already retired, is spread over the average future working period of all employees who are on the work force at the date of valuation. This is normally done by using a percentage of payroll (Hicks, 1965).

As compared to the individual level method, the averaging in this method tends to reduce the high initial cost but it also

increases the later costs somewhat because the total past service cost is funded in level amounts over the average future service lives of employees rather than in gradually decreasing amounts (Ganner and Kingsbery, 1966).

The aggregate method is used mainly with trust fund plans and with plans funded under deposit administration contracts. Under this method, actuarial gains and losses are handled by spreading them over future periods (Hicks, 1965).

K. ATTAINED AGE NORMAL METHOD

The attained age method is similar to the aggregate method or individual level premium method except that past service liability is treated separately in all funding arrangements. The cost of benefits assigned to years after the inception of the plan is spread over the remaining average service life of employees in the work force at the date of valuation. Under this method normal cost contributions are normally determined as a percentage of payroll (Ganner and Kingsbery, 1966).

Considerations in determining annual past service cost contributions are the same as those used for the unit credit and entry age normal methods. The past service cost may be comprised of an amount equal to interest on the unfunded balance or it may include interest plus amortization of principle. The attained age normal method is used with trusteed plans and deposit administration contracts (Hicks, 1965).

III. PRIVATE PENSION PLANS

A. INTRODUCTION

Chapter III presents the pension plans of the private sector. Sections B and C discuss how pensions have evolved in the private sector and provide some of the reasons for recognizing retirement benefits as part of employee compensation. The remainder of the chapter discusses the different characteristics of a typical private pension plan and how the Employee Retirement Income Security Act of 1974 affects each. The characteristics discussed are: participation eligibility, retirement ages, vesting, benefits, accounting basis, and insurance.

B. EARLY PRIVATE PENSION PLANS

Private pension plans in the United States date back to 1875 when the first formal plan was established by the American Express Company. Though established at this early date, pension plans only covered about 3 to 4 million workers before 1935. The voluntary retirement age for these early plans ranged from age 70 for railroad plans to either 60 or 65 years of age after 20 or 25 years of service for the typical manufacturing pension plan. Most of these plans were non-contributory and non-funded, and none of the early pension plans included vesting (Greenough and King, 1976).

Private pension plans were initially viewed as a "social responsibility" of industry to provide older employees with

adequate retired pay. Since most plans were financed on a pay-as-you-go basis, the benefits to the employee could not be guaranteed. In fact, most plans expressed good intentions of rewarding employees for long and faithful service but the plans were very careful in making it clear that the employee had no contractual right to pension benefits. Logue (1979) states that a typical disclaimer of liability was on the order of:

> This pension plan is a voluntary act on the part of the company and is not to be deemed or construed to be a part of any contract of employment, or as giving any employee an enforceable right against the company. The board of directors of the company reserves the right to alter, amend, or annul or cancel the plan or any part of it at any time. The right of the company to discharge any employee at any time shall not be affected by this plan, nor shall such employee have any interest in any pension after discharge (p. 17).

This type of disclaimer was upheld in several court cases and thus one can only conclude that early pension plans were administered through the good-will of the employer showing gratitude for long and faithful service of the employee by rewarding them financially in their old age.

In the late 1940's the Deferred Wage Theory of pensions was gradually recognized. According to Logue (1979), the theory was based on the premise that the worker's interest in pension plans was not based solely on reasons of old age and long and faithful service. It was believed that pensions were attractive to employees because of the tax advantage they received by deferring a portion of their wages until they retired. Under defined contribution plans it was felt that

if an employee was in a lower tax bracket after retirement, and if expected returns of the pension fund were equal to or greater than what an individual could expect to achieve, then employees would be better off by having part of their compensation go into a pension fund (Logue, 1979). A problem with this viewpoint is that few pension plans vest immediately. As a result, those employees who do not vest do not receive full compensation for their labors. Likewise, many pension plans vary the amount of benefits paid to employees inversely with their retired social security benefit. Logue (1979) rejects the deferred wage basis for pension plans arguing that if pensions were merely deferred wages, then employers would not have the right to take away wages that the employee had legitimately earned.

Logue (1979) views pensions as contingent claims. Since an employee must normally work for a firm for a specified number of years before becoming qualified for pension payments (vested), the employee bears a considerable amount of risk. At the time of initial employment an employee accepts a contingent claim against the firm. If an employee quits or is fired before being vested the value of the claim is zero. After vesting, the value of the claim is determined by an agreed-upon formula.

As discussed earlier, if pensions were simply deferred wages, then employees should have the right to immediate vesting. Since most plans do not provide for immediate vesting, the

plans must offer something more than a deferred wage to off-set the risk assumed by vesting requirements. What is offered in addition to the deferred wage component is benefit sharing among employees and with the firm.

Benefit sharing among employees is derived from the assumption that not all employees who are hired will remain with the firm until vesting or retirement. Therefore, the deferred wages of those employees who depart early are not paid to them but are spread among the remaining employees. As a result, employees who continue until vesting or retirement become entitled to more benefits than otherwise would have been due them. Benefit sharing with the firm is derived from employer savings which are directly attributable to employee contractual arrangements. This savings is based on the hypothesis that vesting requirements and other provisions for pension eligibility reduce the turnover rate of employees. As a result, a savings is recognized in the form of reduced recruiting and training costs and a portion of these savings are passed on to the employee through increased pension benefits (Logue, 1979).

Logue (1979) concludes that employees accept the risk of receiving part of their compensation in the form of pension benefits because the firms set aside more for the employee than the employee would have set aside for themselves if there were no pension plan.

C. TODAY'S PENSION PLANS

Coverage under private pension plans has increased markedly over the past two decades. Between 1959 and 1973 the number of covered workers rose threefold to almost 30 million and as a result approximately half of the workers employed in the private sector are now covered by a pension plan (President's Commission, 1981).

The rapid expansion of coverage under pension plans brought with it increased government regulation of pension plans. Even though the private pension system was well established by the early 1970's, many potential weaknesses of the plans existed. As an example, among employees over fifty with ten or more years of service, only half were fully vested. Some employers set such stringent vesting and participation requirements that many workers reached retirement only to discover that because of some break in service they were not eligible for pension benefits (Munnell, 1982). As a result, Congress adopted the Employee Retirement Income Security Act of 1974 (ERISA). The purpose of ERISA is to ensure that protections and guarantees are provided for employees who are covered by private pension plans (DOL, 1976).

The principle features of today's private pension plans include: disability, death, and survivor benefits; age, service, and early retirement provisions; vesting provisions; benefit schedules; and financing arrangements (Logue, 1979). Disability,

death, and survivor benefits will not be looked at in this study. The remaining features are discussed in the sections to follow.

D. PARTICIPATION ELIGIBILITY

Minimum lenth-of-service requirements are usually set for the purpose of lowering administrative costs through the elimination of processing "ins and outs" of short-term employees. Prior to ERISA many plans excluded younger workers, especially those under thirty, workers with less than five or ten years of service, and those who were hired late in life (Munnell, 1982).

ERISA changed the eligibility requirements substantially by requiring that all employees who reach the age of 25 and have completed 1 year of service be included in the plan. An exception to this is that when a plan provides full and immediate vesting, then eligibility may be delayed until an employee reaches the age of 25 and has completed 3 years of service. Generally, 1000 hours in a calendar year is considered a year of service under ERISA. ERISA also prevents employees from being eliminated from the pension plan for reasons of old age. An exception to this is that defined benefit plans can exclude an employee if employment is commenced within 5 years of reaching the plan's normal retirement age (DOL, 1979).

E. RETIREMENT AGES

The age at which employees become eligible to receive a pension benefit greatly influences the retirement decision for most workers. For many years the age of 65 has been viewed as the normal retirement age for receiving full pension benfits and as such has become the age when society no longer expects people to work (President's Commission, 1981). Today three out of four corporate pension plans have a normal retirement benefit age of 65. Additionally, under ERISA, plans are not permitted to delay payment of benefits beyond the age of 65 unless the participant requests such a delay or the employee has participated in the company's pension plan for less than ten years (Munnell, 1982).

Early retirement provisions, which usually provide for retirement before the normal age with reduced benefits from those payable if retirement were delayed until the later normal age, may also be included. Many of these early retirement provisions provide for reduced retirement benefits as early as age 55 (President's Commission, 1981). A 1974 Bureau of Labor Statistics study of defined benefit plans revealed that out of 1467 plans surveyed, ninety-five percent of the covered workers were in plans that provided provisions for early retirement benefits. However, only one percent of these plans paid full normal retirement benefits to early retirees and the remainder of the cases paid early retirees reduced benefits. (Munnell, 1982).

F. VESTING

Vesting of pension benefits means that at a specified point in time an employee gains a contractual claim on pension payments. The rights to benefits are earned and cannot be lost regardless of whether he leaves his job, is fired or laid off, or leaves his union (DOL, 1979).

Vesting may be immediate or deferred, and either full or partial with step increases. Immediate full vesting means that for each year of participation in a pension plan an employee is guaranteed a full increment of the retirement benefit. In contrast, deferred full vesting means that an employee must work for a specified number of years before becoming vested and then the employee becomes entitled to full benefits retroactive to that individual's first participation in the plan. Partial vesting (graded vesting) means that an employee becomes entitled to only a portion of the pension benefit for each year of participation in the plan. As an example, a plan can provide for immediate vesting of 10 percent of the benefit after one year of participation with a 10 percent increase for each additional year up to 10 years when an employee would be eligible for 100 percent of the benefit (Greenough and King, 1976).

The Employee Retirement Income Security Act of 1974 requires that private plans must provide for full and immediate vesting of benefits derived from employee contributions. With regard to employer contributions, the Act requires that one of the following three vesting methods must be adopted as a minimum standard:

1. Full (100 percent) vesting after 10 years of service. No vesting is provided for less than 10 years.

2. Graded vesting from 5 to 15 years of service. Under this method an employee gains an unforfeitable right to 25 percent of the pension after 5 years of service, plus 5 percent for each additional year of service up to 10 years, plus 10 percent for each additional year up to 15 years. This plan provides for 25 percent of the pension being vested after 5 years, 50 percent after 10 years, and 100 percent after 15 years.

3. Rule of forty-five based on age and service. This method provides that if an employee has completed five years of service and the sum of the employee's age and years of service add up to forty-five, then the employee is entitled to 50 percent vesting. For each year of service thereafter the employee receives an additional 10 percent vesting up to 100 percent. Additionally, each employee with 10 years of service must be vested for at least 50 percent of the benefit regardless of age and must receive an additional 10 percent vesting for each year of service thereafter. (DOL, 1979; Munnel, 1982; Greenough and King, 1976; Logue, 1979). Of the three options available, a majority of U.S. corporations have adopted the first option of providing full vesting after 10 years of service (Munnell, 1982).

G. BENEFITS

The benefits paid by a private retirement income program varies widely because of differences in objectives and in individual work and earnings histories. In discussing retirement benefits a distinction must be made between conventional plans and pattern plans. A conventional plan is typically a single employer plan with a contract between the employer and nonunionized employees. A pattern plan is usually union-negotiated. The main difference between these two plans is that conventional plans use salary history and all years of service to determine benefit levels while pattern plans pay a flat dollar benefit for each year of work (usually up to some maximum) irrespective of salary history (Logue, 1979).

Conventional plans typically base benefits on a formula that takes into account the number of years of service, the historical salary of an employee, and some percentage specified in the plan. A simple example of such a formula might be:

Annual pension benefit = Salary Basis x Number of years of service x 0.015

The salary basis and percentage used may differ greatly from firm to firm. The salary basis used can range from an average of the entire career earnings history of an employee to the final pay of an employee (Logue, 1979).

The trend over the last fifteen years has shown that final average pay formulas are being used more and more, increasing from 55 percent in 1960 to 75 percent in 1975. Of those plans using final average pay formulas as a salary

basis, 95 percent used the five consecutive years of highest pay or the five years immediately preceding retirement as the period for averaging. This trend is not surprising considering the inflation in the United States over these years. By focusing on final average pay, firms are providing some protection from inflation for those employees who are nearing retirement (Logue, 1979).

Table I shows the approximate annual median pension benefit as a percentage of final year's compensation under conventional plans. Salaries ranging from $9,000 to $50,000 are used along with the assumption of 30 years of service prior to retirement. The table is based on 1975 data (Logue, 1979).

TABLE I

Median Pension Benefits

Final Salary	Annual Benefit	Percent of Salary
$ 9,000	$ 2,610	29%
15,000	4,800	32
25,000	8,750	35
50,000	19,000	38

As mentioned earlier, pattern plan benefits are based on a flat dollar benefit for each year of service regardless of salary. A 1975 study by the Banker's Trust Company reported that the median benefit under a pattern plan was $108 per year of service with a range from $66 to $193. This equates to an annual median pension benefit of $3,240 for employees retiring under pattern plans with 30 years of service (Greenough and King, 1976).

In 1975, approximately 7 million employees received $14,810 million in benefits from coverage under private pension plans for an average of $2,100 per retiree. In 1980 this increased to 9.1 million employees receiving $35,177 million in benefits for an average of $3,866 per retiree (Munnell, 1982).

H. ACCOUNTING BASIS

Chapter II discussed two methods of financing retirement income benefits, namely pay-as-you-go (cash basis) and advanced funding (accrual basis). In dealing with private pension plans, Federal law regulates the financing of the plans by setting minimum funding level requirements for the purpose of ensuring that adequate funds are available to pay future benefits. As a result, pay-as-you-go basis of accounting is not a viable alternative to be used with private pension plans (President's Commission, 1981). Additionally, Generally Accepted Accounting Principles recognize accrual basis as the accepted method for accounting for pension costs (Miller, 1982).

Prior to 1974 firms were required to fund their private pension plans at a minimum level to ensure that benefits currently earned by participants were covered. To meet this minimum funding level, annual pension plan contributions equal to the plan's normal cost plus interest on the unfunded prior service cost were required. With the enactment of ERISA in 1974 the funding requirements were made more stringent. Under ERISA, employers are now required to fully fund the normal cost each year and the prior service cost must be amortized

over a period not to exceed forty years. The amortization payments must cover both principle and interest (Munnell, 1982).

The Employee Retirement Income Security Act of 1974 requires that when normal cost and past service cost are used for determining contribution levels, the costs must be determined by using an acceptable actuarial cost method. ERISA recognizes six acceptable actuarial cost methods: the unit credit method; the entry age normal method; the attained age normal method; the individual level premium method; the aggregate method; and the frozen initial liability method (Gibson, 1981). A 1964 survey of what actuarial methods are actually being used revealed that of 163 companies responding: 42 percent used the unit credit actuarial cost method, 37 percent used the entry age normal method, 7 percent used the attained age normal method, and the remaining companies used other methods (Ganner and Kingsberry, 1966). In contrast, the Wyatt Company's 1982 survey of 813 pension plans with 1000 or more active participants showed the following results: 40 percent used the entry age normal method, 22 percent used the frozen initial liability method, 20 percent used the unit credit actuarial cost method, 8 percent used the aggregate method and 1 percent used other methods (Wyatt Company, 1982).

Contributions to a private pension plan fund can either be made entirely by the employer (non-contributory plans) or they can be made by both the employer and the employee (contributory plans). In most plans the employee's portion is refunded, but not the employer's portion, if employment is terminated prior

to vesting (Logue, 1979). Today the trend is towards private pension plans being financed solely by the employer. A 1979 Bureau of Labor Statistics study reported that 77 percent of all private pension plans are non-contributory (DOL, 1980). One reason for private plans being non-contributory is that the tax advantage available from employer contributions to private pension plans have created a strong incentive for employers to exclusively finance pension benefits (Munnell, 1979).

I. INSURANCE

A major weakness of early pension plans was that participants did not hold any legal claim against a firm for payment of unfunded vested pension payments. Employee claims were against the pension fund, not the firm. As a result, if a firm went out of business or terminated its pension plan, the employees with vested pension claims were only entitled to receive pension benefits to the extent that the fund had adequate resources. Recognizing this problem, the Employee Retirement Income Security Act of 1974 established a requirement for all firms to insure their pension funds through either private insurance or through a newly established federal pension insurance system called the Pension Benefit Guaranty Corporation (PBGC). Additionally, under ERISA firms were now held liable for pension fund deficiencies (Munnell, 1982).

The Pension Benefit Guaranty Corporation is a nonprofit body which is set up within the Department of Labor for the

purpose of insuring private pension plan participants against the loss of vested benefits due to termination of the plan. To finance this termination insurance, an uniform premium of $2.60 per year for each participant is assessed against the employer. In the event that a firm terminates its pension plan without having sufficient assets in its pension fund, the Pension Benefit Guaranty Corporation will pay participants up to a maximum of $1,381 per month (Munnell, 1982). To pay for the cost of these pension claims, Pension Benefit Guaranty Corporation has the right to attach up to 30 percent of the firm's net worth. The claim against the firm has the same status as a tax lien and therefore in the event of bankruptcy, the pension fund's claim against the firm is senior to the claims of secured and unsecured debt holders (Logue, 1979).

In summary, the Employee Retirement Income Security Act of 1974 has improved private pension plans in three ways. First, ERISA's participation and vesting requirements have created pension guarantees that would not have existed without legislation. Second, funding requirements have led to pension contributions that otherwise would not have been made. Finally, up to 30 percent of corporate assets can now be committed to financing pension benefits under the authority of the Pension Benefit Guaranty Corporation. As a result of these changes under the Employee Retirement Income Security Act of 1974, private pension plans have been established as serious commitments whose fulfillment is backed not only by pension fund assets but also by the assets of the corporation.

IV. PUBLIC EMPLOYEE PENSION PLANS

A. INTRODUCTION

Chapter IV provides a discussion of public employee pension plans. In Section B a brief discussion on the background and history of public employee pension plans is presented. The remaining sections discuss the typical characteristics of federal, state, and local employee pension plans. The characteristics discussed are: participation eligibility, retirement ages, vesting, benefits, and accounting basis.

B. HISTORY

The first public employee pension plans date back to 1857 when the New York City police force was provided a pension in the event of disability or a lump-sum payment in the event of death. This first plan was financed by miscellaneous sources, such as donations and proceeds from confiscated and unclaimed property. It was not until twenty-one years later, in 1878, that non-disability retirement benefits were made a part of the plan. Under this provision, New York policemen were allowed to retire without proof of disability at half their final pay at age 55 with twenty-five years of service. The New York firemen received a more generous plan at this same time, receiving half their final pay after twenty years of service (Tilove, 1976).

During the next half century many other municipal employee pension plans were brought into existence but only select groups of employees were covered: namely policemen, firemen and teachers. Financing for these first plans were either entirely by the government or entirely by the employees themselves (Greenough and King, 1976).

In 1911 Massachusetts established the first retirement system at the state level which covered the general employees of the state. Prior to this time, the only public employee plans were at the municipal level. During the 1920's retirement plans for public employees grew in numbers and coverage. Most of these plans provided separate coverage for special employee groups such as policemen, firemen, teachers and general state employees. By 1940 approximately half of all state and local employees were covered by a retirement system and by 1962 an estimated three out of four public employees had such coverage (Greenough and King, 1976).

In 1976 state and local government retirement systems covered approximately 10.3 million employees and the proportion of full time state and local employees covered by such plans was 90 percent. Annual benefits paid in 1976 were between $6 and $7 billion (Winklevoss and McGill, 1979).

The Federal Civil Service Retirement System was established in 1920 with 330,000 civil servants coming under the initial plan. Participation in the initial plan was limited primarily to those in the classified civil service, however, in 1942 coverage was extended to include all officers and employees of

the executive, judicial and legislative branches of the U.S. Government and the municipal government of the District of Columbia. In 1946 congressmen were allowed to participate in the plan. By 1969 almost 2.8 million and more than 9 out of 10 federal civilian employees were covered by the civil service retirement system (Mackin, 1971).

The principle features of today's public employee retirement systems include: disability, death, and survivor benefits; age, service, and early retirement provisions; vesting provisions, benefit schedules, and financing arrangements. As in the discussion on private pension plans, disability, death, and survivor benefits will not be discussed.

C. PARTICIPATION ELIGIBILITY

Almost all state and local employee pension plans provide for immediate participation by all full-time employees. Part-time and temporary employees are not usually eligible to participate. For those plans that do impose service requirements, 6 or 12 months is usually the waiting period that is set. Participation in the Federal Civil Service Retirement System is automatic except for members of Congress and certain employees of the legislative branch who have the option of participating (Greenough and King, 1976).

D. RETIREMENT AGES

The normal retirement age for public employees is not as precisely set as is the case for private plan employees. Public employee pension plans have retirement ages ranging

from no minimum age to age 65, with 70 percent having a normal retirement age under 65. Most plans have a single combination of age and service requirements to be met prior to retiring with full benefits (Tilove, 1976). Tilove (1976) states that the most common combinations used in order of frequency are:

1. Age 60, generally with a minimum of ten years of service.
2. Age 65, with no minimum service required.
3. Age 55, with in most cases a minimum of twenty-five years of service but more commonly thirty or more.
4. Any age, with a minimum of thirty or thirty-five years of service.

Under the Federal Civil Service Retirement System a number of combinations of age and service are provided for normal retirement without reduction of benefits. Full retirement benefits are payable, at the option of the employee, at age 55 after 30 years of service or at age 60 with 20 years of service or at age 62 with 5 years of service. Congressmen may retire at age 60 with 10 years of service or at age 62 after 5 years of service (Greenough and King, 1976).

Most state and local pension plans allow employees to retire with reduced benefits at a younger age or with less service than is required for normal retirement. The benefits for employees retiring early are typically actuarially reduced to provide for the expected longer period of payment (Tilove, 1976).

Compulsory retirement age provisions are incorporated in about 79 percent of the state and local pension plans with the majority setting age 70 as the age for compulsory retirement. Some states and localities have age 65 set as the age for compulsory retirement unless the employer specifically allows a continuation of service. For Civil Service employees retirement is compulsory at age 70 after 15 years of service (Greenough and King, 1976).

E. VESTING

Vesting provisions under state and local employee pension plans are comparable to those of private plans. Vesting is generally full rather than partial, and it most commonly depends on some specified period of service. Immediate vesting is rare (Tilove, 1976). The most common length of service requirements for full vesting and their percentages are: thirty-one percent after 5 years, 18 percent after 10 years, 23 percent after 15 years, and 19 percent at 20 years. Federal Civil Service employees are vested after 5 years of plan participation (Greenough and King, 1976).

F. BENEFITS

Public employee retirement plans overwhelmingly use final-pay plans to determine pension benefits. Final pay plans use the same three-element formula that is most commonly employed by private pension plans to compute benefit payments. The elements of the formula are: a stated percentage times years of service times final average salary (Tilove, 1976).

The benefit formulas of most state and local plans use either the highest three years of average salary (30 percent) or the highest five years (54 percent). The number of plans using a career average is negligible (Tilove, 1976). As with private plans, the trend is towards using final average salaries so that related pension benefits are provided some degree of protection against inflation for those employees nearing retirement. The percentage factor used varies from 1 percent to 2 percent of final average salary for each year of service depending upon the system, with the most frequently found factor to be approximately 1.5 percent of final average salary for each year of service, or 45 percent of final average salary for 30 years of service (Greenough and King, 1976).

The Federal Civil Service Retirement System uses a three-element formula for computing retired benefits, however, the percentage factor is applied in three successive steps according to years of service. Final average salary is determined by the average salary during the highest three consecutive years. The benefit formula is applied as follows: 1.5 percent per year for the first 5 years, 1.75 percent for the next five years, and 2 percent per year for each year thereafter up to a maximum pension of 80 percent. The reason for the step formula is to provide a benefit in favor of long-service employees (Munnell, 1979).

G. ACCOUNTING BASIS

As in the case of private pension plans, the method of financing retirement benefits for public employee pension plans ranges from pay-as-you-go (cash basis) to advanced funding (accrual basis). Since public pension plans do not come under the jurisdiction of ERISA, they are not required by law to fund their pension plans. As a result, public pension plans must deal with the issue of whether to fund or not fund their pensions and, if funding is elected, to what extent (Munnell, 1979).

Proponents for pay-as-you-go financing argue that reserves for paying pension benefits are not needed since public authorities are bound to fulfill benefit commitments and federal, state and local governments have the power to tax and therefore will be able to raise the needed money. A second argument presented is that reserves would merely serve as an invitation to enact benefit increases without an increase in contributions, i.e., in the future it might be argued that reserves are not needed or at least they are too large, and authorities may be persuaded to give higher benefits without higher contributions. A final argument for pay-as-you-go financing is that the relatively "soft dollars" of the future will make it easier to contribute. A "soft dollar" is the depreciated value of the dollar over time (Tilove, 1976).

Advocates of funding feel that the single most important consideration in favor of funding is that it helps enforce

responsibility. Funding prevents those in authority from adopting lavish benefit provisions for today's workers, while passing the cost on to future generations. Another argument in favor of funding is that investment earnings on pension funds will reduce future contribution requirements. On the average, earnings from investments make-up 26 percent of the total receipts of state and local retirement systems. As a result, funding can mean a smaller total outlay of public funds for pension benefits (Tilove, 1976). Munnell (1979) makes the following points for the desirability of funding at the state and local level:

1. To enforce fiscal responsibility through explicit recognition of the long-term costs of proposed benefit changes.

2. To ensure that adequate revenues are available to fulfill future pension obligations.

3. To allocate pension costs as benefits accrue so that they are financed by the generation that enjoys the services of public employees.

4. To strengthen the position of state-local governments in financial markets to avoid excessive interest costs or low credit ratings due to large unfunded liabilities.

The present trend in financing of public pension plans is towards some level of funding. A 1978 pension task force report on public employee retirement systems indicated that only 17 percent of state and local pension plans and 35 percent of federal pension plans use pay-as-you-go as a basis for financing benefits. The remaining plans use some method of

funding to accumulate reserves to pay for benefits in the future (Munnell, 1979). The level of funding can be either partial or full. Munnell (1979) maintains that public pension plans have less of a need for full funding of benefits than private plans due to the fact that public plans are supported by governments which have perpetual life and the power to tax. Today's funding of public pension funds bear out Munnell's feeling with the typical federal, state, or local pension plan employing partial funding vice full funding.

At first glance public pensions appear to be considerably more generous than private pension plans considering the differences in benefit formulas, salary averaging periods, and retirement ages. However, when employee contributions are taken into consideration, this difference narrows substantially. As an example, a 1971 New York State Department of Labor survey revealed that a New York state or local government employee with 30 years of service and final salary of $10,000 received 49 percent of the final salary under New York's public pension plan as compared to 24 percent for a worker under a private pension plan. However, once the public employee's contribution is considered, the net rate for the public employee drops to 34 percent. Additionally, for workers with shorter periods of service the difference is even smaller. For a worker with 20 years of service and a final salary of $10,000, the net rate for the public employee is 23 percent of final salary as opposed to 17 percent for the employee under a private pension plan (Munnell, 1979).

Ninety percent of the state and local plans are contributory as opposed to only 33 percent of the private plans. Virtually all federal civilian employee pension plans have an employee contribution provision. State and local plans normally require employee contributions of 5 to 7 percent of wages while the civil service system receives employee contributions of 7 percent of wages. In 1975, approximately 35 percent of contributions to state and local plans were financed by the employee and 16 percent of the federal contributions were made by the employee. In contrast, less than 8 percent of the contributions to private plans were made by employees (Munnell, 1979).

V. MILITARY APPLICATION

A. ALTERNATIVES

As discussed in Chapter I, the objective of this thesis is to determine an appropriate method for accounting for the cost of retired benefits so that the full cost of a manpower decision can be identified in the period in which decisions are made regarding the utilization of that manpower. As seen in Chapter II, the current generally accepted procedures for accounting for retirement costs is through the use of accrual basis accounting along with actuarial cost methods. Actuarial cost methods are used to determine the normal cost and past service cost needed to fund pension plans. The funding of the military retirement system is not within the scope of this thesis, therefore the mechanics of funding a retirement plan will not be discussed. Appendix I contains a summary of the work done by the Defense Manpower Data Center showing a method for fully funding the military retirement system.

Actuarial cost methods were designed primarily as funding techniques, however, the methods may also be used for determining pension costs for accrual basis accounting (Hicks, 1965). It is this second use, the determination of pension costs under accrual basis accounting, that will be considered in this chapter. A decision on funding the military retirement system has no bearing on the importance of using accrual basis accounting

for the military retirement system. Accrual basis accounting is the recognized method for matching expenses with the period in which they are incurred (Welsch and Anthony, 1981). Accrual basis accounting allocates costs to the period of employment, not the period of retirement. Therefore, accrual basis accounting is the approach that will be used along with actuarial cost methods to assign the cost of future retirement benefits to the period in which they are earned (Tilove, 1976).

In discussing actuarial cost methods to be used in determining yearly retirement costs, past service costs will not be considered. As previously defined, past service cost is the pension cost assigned to years prior to the inception of a pension plan. Past service cost plays an important role in the overall funding scheme of a pension plan but it has no effect on the current year's accrued cost for benefits earned. On the other hand, normal cost is the annual cost assigned under actuarial cost methods to years subsequent to the inception of a pension plan. It is this cost that is recognized as the yearly cost of future pension benefits (Hicks, 1965).

Along with the normal cost, actuarial gains and losses must also be considered in determining the correct portion of the cost of future benefits to be assigned to the current year. Actuarial gains and losses are the variances between the actuarial assumptions used in calculating retirement costs and the actual results of experience. The gains and losses can be applied on the immediate basis (assigned entirely to the

current year) or the spread basis (ammortized over a number of future years) (Phoenix and Bosse, October 1967).

In deciding which actuarial method should be employed, generally accepted accounting principles provide that any of the actuarial cost methods discussed in Chapter II are appropriate as long as costs are allocated in a rational and systematic manner (Hicks, 1965). In determining which actuarial cost method is most appropriate for use in allocating the cost of the military retirement system the following points are applicable:

1. The individual level premium method and the aggregate method are not considered to be appropriate alternatives for determining accrued military retirement costs. Both of these methods combine the past service cost with the normal cost in arriving at the cost to be applied to a given year. As discussed earlier, only the normal cost and actuarial gains and losses are to be recognized in determining the current year's portion of the cost of future retirement benefits.

2. The unit credit cost method is not commonly used by public employee retirement systems. One reason is that the method is not readily applicable to plans which base benefits on final salary. The unit credit cost method calculates the amount needed to purchase a unit of retirement benefit based on a percentage of the current year's salary. Since the military's retirement benefit is based on the final month's basic pay (average of the highest 36 months of basic pay for members entering the service after September 8, 1980), the

method is not suited for determining the accrued cost of military retirement benefits. A second reason is that the present value of each year's unit of cost is used as the normal cost charged to that year. Under this method, the normal cost becomes larger each year because the closer an employee gets to retirement the shorter the period becomes for providing for the present value of the future retirement benefits. As a result cost increases with age and does not necessarily reflect the period's true accrued protion of the benefit cost (Smith, 1977).

3. The entry age normal method is the most widely used actuarial method by both public and private pension plans. The attractiveness of the entry age normal method is that it develops a level annual amount or percentage of pay to be spread over the employee's total years of active service. Each year of service shares equally in accounting for the normal cost of an individual's future retirement benefits. Additionally, a level percentage of payroll is preferable because it provides a fair spread of cost between generations and between present and future price and income levels. (Tilove, 1976; Wyatt Company, 1983) Frankel and Butler (1982) have incorporated this method in the calculation of retirement costs for the enlisted billet cost model. Finally, Smith (1977) maintains that selection of the appropriate actuarial cost method and the implementation of that method is the proper function of the actuary because only the actuary has the expertise and professional judgement necessary to make the

decision. If one agrees with Smith's position then the entry age normal method, which is utilized by the Defense Manpower Data Center (DMDC) actuary in the valuation of the military retirement system, should be considered as an appropriate method for allocating military retired costs.

The entry age normal method can be applied on the individual basis or the aggregate basis. Both of these methods will be explored to see how each is applied in allocating the yearly cost of future retirement benefits. In applying the entry age normal method actuarial gains and losses must be considered as a part of each year's retirement cost. Gains and losses occur due to differences in what actually transpired and what had been assumed to take place through the use of actuarial assumptions. Actuarial gains and losses are, at best, an indication of the short term accuracy of the actuarial assumptions used. Since retirement costs are viewed as long-range costs, Hicks (1965) in APB No. 8 maintains that actuarial gains and losses should be spread over a reasonable period of years, either through the normal application of the actuarial method or by separate adjustments (Phoenix and Bosse, October 1967). The most common method used in spreading is to spread all unamortized gains and losses over the future service lives (or payroll) of the active plan participants. In application, the adjustments are usually included in the calculation of the current year's normal cost. This method has the advantage of spreading the gains and losses over an annually revised period

approximately equal to the future service-life of the active members instead of amortizing the gains and losses over some fixed period. (Dreher, 1967; Tilove, 1976).

Of the two techniques used for employing the entry age normal method, the individual basis and aggregate basis, the former will be discussed first.

B. INDIVIDUAL BASIS

The individual basis, as the word implies, is used for calculating the retirement cost for an individual participant of a plan. In calculating the current year's cost of an individual's retirement benefit, both normal cost and actuarial gains and losses are recognized. Under the entry age normal method, the normal cost is the level annual amount for each employee which, if accumulated over each member's entire service-life, would provide for the employee's full pension at retirement. Actuarial gains and losses on the other hand, are the difference between the normal cost under actual conditions and normal cost under assumed conditions. The gains and losses are spread over the remaining service-life of the individual resulting in only a portion of the gains/losses being charged to the current year. The sum of the normal cost and the current year's portion of the gains/losses equals the current year's accrued retirement cost for an individual service member.

In applying the individual basis to the active force as a whole, known historical averages combined with projections for the future can be used to determine the current year's

accrued retirement cost for each entrant group. This technique is illustrated in Section D of this chapter.

C. INDIVIDUAL BASIS METHOD

An entry age normal method, individual basis, can be used for either an individual, or an entrant group as a whole, in calculating the current year's accrued retirement cost for a retiree(s) expected to retire in a given pay grade. The accrued retirement cost for an individual is determined first, steps 1-3 below, and then the cost for the entrant group is derived in step 4. The methodology used for the individual basis is as follows:

1. Individual normal cost computation.
   a. Calculate the annual retired annuity, A(G,LOS), for an individual retiring in pay grade, G, and length of service, LOS. The current military retired pay formula is used.

$$A(G,LOS) = \min(2.5\% \times LOS, 75\%) \times BP \times 12$$

where: LOS = length of service at retirement

G = pay grade of retiree

BP = final monthly basic pay (ave. of the highest 36 months of basic pay if entered after September 8, 1980)

   b. Calculate the present value of the future retirement benefits, P, as of the date of retirement.

$$P = A(G,LOS)\left[\frac{1 - \frac{1}{(1+i)^L}}{i}\right]$$

where: A(G,LOS) = annual retired annuity

i = annual discount rate

L = life expectancy of individual at date of retirement

c. Calculate the normal cost, NC, which is the level annual cost associated with providing for the future retirement benefits.

$$NC = P\left[\frac{i}{(1+i)^n - 1}\right]$$

where: P = present value of future retirement benefits

i = annual discount rate

n = number of years that normal cost contributions are made

2. Individual actuarial gains and losses computation.

a. Calculate the actuarial gains/losses, F, by taking the difference between the normal cost under current conditions, NC, and the normal cost under actuarial assumptions, AC. The normal cost under actuarial assumptions, AC, is determined in the same manner as the normal cost under current conditions, NC, except that the previous year's actuarial assumed conditions are used instead of the current actual conditions in calculating the present value of future retirement benefits, P, and the normal cost under actuarial assumptions, AC. (This presumes that the plan has been

in use for more than one year. Actuarial gains and losses are not a factor in the initial year of implementation).

$$F = NC - AC$$

where: NC = normal cost under current conditions.

AC = normal cost under actuarial assumptions

3. Current year's total individual retirement cost computation.

a. Calculate the current year's portion of the gains/losses applied, Fa. Under the individual basis gains and losses are spread over the remaining expected work-life of the individual.

$$Fa = (F + Fd)\left[\frac{i}{1 - \frac{1}{(1+i)^{RWL}}}\right]$$

where: F = current year's gains/losses

Fd = prior year's deferred gains/losses

RWL = remaining work-life of an individual

i = annual discount rate

b. Calculate the current year's total retirement cost, RC, for an individual expected to retire in grade, G, and length of service, LOS.

$$RC = NC + Fa$$

where: NC = normal cost under current conditions

Fa = gains/losses applied to current year

4. Total current year's retirement cost computation for all individuals in an entrant group who are expected to retire in pay grade, G, and length of service, LOS.

a. Calculate the number of people, N, from a given entrant group who are expected to retire in pay grade, G.

$N = I \times Pr(R) \times Pr(G)$

where: I = number of entrants for a given year

$Pr(R)$ = probability of entrant reaching retirement, R

$Pr(G)$ = probability of entrant retiring in given pay grade, G

b. Calculate the current year's total retirement cost, TRC, for all individuals in an entrant group who are expected to retire in pay grade, G, and length of service, LOS.

$TRC = RC \times N$

where: RC = total retirement cost for an individual

N = number of people expected to retire in pay grade, G

D. INDIVIDUAL BASIS EXAMPLE

The following example demonstrates the use of the methodology discussed in Section C. Hypothetical data (an approximation of 1982 actual data) is used to compute the 1982 retirement cost for members who entered the military in 1964 and are expected to retire in pay grade E-7, after 22.2 years of service (DOD, April 1982).

1. Participant data and actuarial assumptions.

Year of service entry	1964
Grade at retirement	E-7

LOS at retirement	22.2 (ave. LOS for E-7's receiving retired pay)
Entrant age	19
Retirement Age	41
Life expectancy assumption	32.95
Discount rate	10.0%
Annual salary scale increase	7.5%
1982 E-7 basic pay @ 22 YOS	\$1,522.20
Projected 1986 E-7 basic pay	\$2,032.85
Deferred gains and losses	(\$4.75)
Normal cost under assumed conditions (calculated using previous year's assumed conditions)	\$1,631.10
Probability of new entrant retiring	.11
Proportion of entrants retiring as E-7's	.433
Number of new entrants in 1964	230,000

2. 1982 individual normal cost computation.

a. Calculate the annual retired annuity, A(G,LOS), for an E-7 expected to retire in 1986 with 22.2 years of service.

$$A(E\text{-}7, 22.2) = 2.5\% \times 22.2 \times \$2{,}032.85 \times 12$$

$$= \$13{,}538.79$$

b. Calculate the 1986 present value of the future retirement benefits, P, for an E-7 with 22.2 years of service.

$$P = \$13{,}538.79 \times \left[\frac{1 - \left(\frac{.1}{1 + .1}\right)^{32.95}}{.1}\right]$$

$$= \$13{,}538.79 \times 9.5674$$

$$= \$129{,}530.67$$

c. Calculate the 1982 individual normal cost, NC.

$$NC = \$129,530.67 \times \left[\frac{.1}{(1 + .1)}^{22.2} - 1\right]$$

$$= 129,530.67 \times .0137$$

$$= \$1775.14$$

3. 1982 actuarial gains and losses computation.

a. Calculate the 1982 individual actuarial gains/losses, F.

$$F = \$1775.14 - 1,631.10$$

$$= \$144.04$$

4. 1982 total individual retirement cost computation.

a. Calculate the gains/losses applied, Fa, in 1982.

$$Fa = \{144.04 + (4.75)\} \left[\frac{.1}{1 - \left(\frac{1}{1 + .1}\right)^5}\right]$$

$$= \$139.29 \times .2638$$

$$= \$36.74$$

b. Calculate the 1982 total individual retirement cost, RC, for a 1964 entrant expected to retire as an E-7 in 1986.

$$RC = \$1,775.14 + 36.74$$

$$= \$1,811.88$$

5. 1982 total retirement cost computation, TRC, for all 1964 entrants expected to retire as E-7's in 1986.

a. Calculate the number of 1964 entrants expected to retire as E-7's, N.

$$N = 230,000 \times .11 \times .433$$

$$= 10,955$$

b. Calculate the 1982 total retirement cost, TRC, for all 1964 entrants expected to retire as E-7's in 1986.

TRC = 10,955 x $1,811.88

= $19,849,145.40

E. CHANGES IN INDIVIDUAL ACTUARIAL ASSUMPTIONS

This section contains a discussion on how changes in the various actuarial assumptions results in the individual's total retirement cost being higher or lower than normal cost. Table II illustrates the effect that actuarial gains and losses have on the total cost for an individual E-7 retiree described in Section D for years 1964-1984. The gains and losses occur as a result of variances between the assumed annual pay scale increase (7.5 percent) and the actual annual increase experienced. Additional gains/losses would normally be expected to occur as a result of variances in the other actuarial assumptions not included in this example. Relatively large gains were recognized in years 1966, 1970, 1973, 1981, and 1982. As can be seen from the table, each of these years' percentage of basic pay increase was well above the assumed 7.5 percent increase. In the majority of the remaining years, losses occurred due to basic pay increasing at a slower pace than the assumed rate.

If the actuarial assumptions used are reasonably close approximations of what actually takes place in the long run, then the short term gains/losses tend to cancel each other out in the long run. In this illustration, the gains tend to balance the losses in long run. The overall difference between

TABLE II

Gains/Losses Amortization

Year	% BP Pay	Gains/ Losses	Applied	Deferred	Year's Cost
1964	14.3%	$ 0	$ 0	$ 0	$1,714
1965	2.3	(79)	(9)	(78)	1,626
1966	10.4	53	(3)	(17)	1,685
1967	3.2	(67)	(10)	(81)	1,611
1968	5.6	(28)	(13)	(97)	1,580
1969	6.9	(9)	(13)	(96)	1,571
1970	12.6	75	(3)	(10)	1,656
1971	8.1	9	0	0	1,668
1972	7.9	6	1	6	1,675
1973	14.4	107	15	108	1,797
1974	6.2	(22)	12	72	1.772
1975	5.5	(32)	6	31	1,733
1976	5.0	(40)	(1)	(12)	1,686
1977	3.6	(61)	(12)	(67)	1,614
1978	6.2	(20)	(15)	(74)	1,592
1979	5.5	(30)	(19)	(87)	1,557
1980	7.0	(7)	(19)	(76)	1,550
1981	11.7	61	(3)	(5)	1,628
1982	14.3	144	37	117	1,812
1983	4.0	(58)	19	35	1,736
1984	4.0	(56)	(9)	(18)	1,653
1985	7.5	0	(11)	(8)	1,651
1986	7.5	0	(9)	0	1,653

the gains and losses for the period 1964-1984 was a net loss of ($53). This loss is the amount by which the overall retirement cost is reduced due to the long run effect of annual salary increasing at a slower rate than had been planned for under the actuarial assumptions. The actual average annual salary scale increase for this same period was approximately 7 percent.

Table III shows what the approximate effect one or another change in actuarial assumptions will have on individual and entrant group normal cost. Computations are based on 301,000 enlisted entrants with 1981 service entry dates. The remainder of the participant data and actuarial assumptions are as stated in Section D of this chapter. The effect that each actuarial assumption has on normal cost is discussed:

1. Change in interest rate. An increase in the annual interest rate from 9½ percent to 10 percent would reduce the entrant group annual normal cost by $9.3 million, or 10.3 percent. Overall, for each ¼ percent increase in the interest rate, normal cost is reduced by approximately 5.2 percent.

2. Change in salary scale. A change in the rate at which the salary scale increases or decreases also effects normal cost. A change in the annual salary scale from 7½ percent to 8 percent results in the annual entrant group normal cost increasing by $8.8 million, or 11 percent. Each ¼ percent increase in the rate that the annual salary changes results in an increase in normal cost by about 5.3 percent.

TABLE III

Changes in Actuarial Assumptions

Interest rate	Individual normal cost	Entrant Group normal cost ($ millions)	percent change
9.50%	$6,307	$90.4	
10.00	5,659	81.1	10.3%
10.25	5,362	76.9	5.2

Salary scale	Individual normal cost	Entrant Group normal cost ($ millions)	Percent change
7.25%	$5,374	$77.0	
7.50	5,659	81.1	5.3%
8.00	6,273	90.0	11.0

Percent retiring	Individual normal cost	Entrant group normal cost ($ millions)	Percent change
10.75%	$5,659	$79.3	
11.00	5,659	81.1	2.3%
11.50	5,659	84.8	4.6

Percent retiring as E - 7's	Individual normal cost	Entrant group normal cost ($ millions)	Percent change
43.25%	$5,659	$81.0	
43.50	5,659	81.5	0.6%
44.00	5,659	82.4	1.1

Life expectancy	Individual normal cost	Entrant group normal cost ($ millions)	Percent change
32.50 yrs	$5,647	$81.0	
33.00	5,660	81.1	0.1%
34.00	5,683	81.5	0.5

LOS	Individual normal cost	Entrant group normal cost ($ millions)	Percent change
21 yrs	$5,243	$75.2	
22	5,648	81.0	7.7%
23	5,698	81.7	0.9

Number entrants	Individual normal cost	Entrant group normal cost ($ millions)	Percent change
295,000	$5,659	$79.5	
300,000	5,659	80.9	1.8%
310,000	5,659	83.6	3.3

3. Changes in the percent retiring from an entrant group and the percent retiring as E-7's from an entrant group. The effect of changes in these two percentages are not as significant as the previous two discussed. An increase from 11 percent to 11½ percent for the percent retiring from an entrant group and from 43½ percent to 44 percent for the percent of those retiring as E-7's, results in an increase in normal cost by $3.7 million, or 4.6 percent, and $.9 million, or 1.1 percent respectively. For each ¼ percent increase in the percent retiring from an entrant group normal cost increases by approximately 2.3 percent. For a ¼ percent increase in the percent retiring as E-7's the normal cost increases by about 0.6 percent.

4. Changes in retired life expectations. The effect of a change in retired life expectations does not have the same degree of impact on normal cost as interest rate and salary scale changes. A one year (3 percent) increase from 33 to 34 years in the length of time that a retiree is expected to live after retirement results in an increase in normal cost of only $.4 million, or 0.5 percent.

5. Changes in the number of entrants. A change in the number of entrants has the effect of changing the normal cost in direct proportion with the change in the number of people entering the service. As can be seen from Table III, an increase in the number of entrants from 300,000 to 310,000 (3 1/3 percent) increases the normal cost by $2.7 million, or 3 1/3 percent.

6. Change in length of service at retirement. The effect that a change in the length of service has on the annual normal cost is dependent upon whether or not the change includes an increase in final monthly basic pay due to a longevity step increase in salary, i.e., at LOS 20, 22, and 26. As an example, a one year increase in LOS from 21 to 22 years, which includes a longevity step increase in basic pay, result in normal cost increasing by $5.8 million, or 7.7 percent. In contrast, a one year increase from 22 to 23 years of service without a longevity step increase results in a normal cost increase of only $.7 million, or 0.9 percent.

From the discussion above, it is apparent that the actuarial assumptions used for determining the annual normal cost can have a great impact on the retirement cost charged to the current year. For this reason it is important that actuarial assumptions be evaluated on a continuing basis to ensure that they accurately reflect the real situation. A survey by Ganner and Kingbery (1966) revealed that 89 percent of 163 plans studied recomputed actuarial assumptions every year.

Of the actuarial assumptions previously discussed, only the interest rate and life expectancy assumptions are completely independent and uncontrollable by the decision maker. The remaining assumptions, salary scale changes, percent retiring, percent retiring in a given grade, length of service at retirement, and number of entrants are factors that can be effected by changes made by the decision maker.

In the previous discussion on changes in actuarial assumptions, various factors were changed and the resultant impact discussed. However, in each case it was assumed that only one of the factors was effected by the change and therefore the results could be easily predicted. In reality, a change in one factor normally will effect the other factors in a manner which may either counteract the intended results of the change or compound them. As an example, an increase in the salary scale may also result in more people staying until retirement age and retiring with a longer length of service. However as the average length of service increases retirement age also increases and given the same life expectancy, the number of years of retirement is shortened. The shortened number of retirement years would help to counteract the effect of the other increases.

TABLE IV

Combined Changes in Actuarial Assumptions

(Dollars in millions)

Chg. no.	Salary scale	% Stay	LOS at retire	Life expect	Entrant group normal cost	Combined percent increase
	7.5%	11%	22.2	32.95	$81.1	
1	8.0	11	22.2	32.95	89.9	10.9%
2	8.0	12	22.2	32.95	98.1	17.3
3	8.0	12	23.0	32.95	99.2	18.2
4	8.0	12	23.0	32.04	98.7	17.8

Table IV illustrates a hypothetical case in which an increase in salary scale (change no. 1) is accompanied by a change in the percent staying until retirement (change no. 2),

the length of service at retirement (change no. 3) and the life expectations after retirement (change no. 4). An initial ½ percent change in salary scale results in normal cost increasing by about 11 percent however, the cumulative effect of changes in salary scale, percent staying until retirement, length of service at retirement and life expectancy after retirement results in an overall increase in normal cost of about 18 percent. As can be seen from this example, to be a useful tool, the decision maker in predicting the change in the retirement cost must consider the total effect a change has on all of the actuarial assumptions. Without this consideration, the results may be significantly different than initially expected.

As discussed in Section C and illustrated in the example in Section D, the retirement cost for an individual entrant can be calculated through the use of an entry age normal method. In practice,. however, the user must be cautious when considering the effects that an individual entrant's retirement cost has on the entrant group as a whole. For instance, to assume that a decrease in the active force by 1000 people would result in a decrease in the retirement cost by the cost of 1000 retirees is erroneous since a portion of the 1000 people would not normally be expected to stay until reaching retirement age even if the force was not reduced. As an example, if the assumed percentage of entrants staying until retirement is 11%, then the retirement cost is only reduced by the cost of 110 (11% x 1000) entrants who are expected to stay until retirement.

The other 890 entrants are expected to leave the service before reaching retirement and therefore can not be considered as part of a cost reduction.

F. AGGREGATE BASIS

The normal cost under the individual basis entry age normal method is computed as a level amount for each participant of the plan. However, when the entry age normal method is applied on the aggregate basis, separate amounts are not computed for individual members. Instead, computation of the costs are based on the total plan with a level percentage of payroll being used to allocate retired costs to the current year (Hicks, 1965).

The level percentage factor to be used in computing the normal cost is derived by dividing the present value of the expected future retirement benefits for the new entrant group by the present value of future salaries of a new entrant group starting their career on the valuation date. The level percentage factor determined from the entrant group data is then applied to the current year's total basic pay of the active force in calculating the year's total normal cost. The present value of future retirement benefits and the present value of future salaries have been computed by The Office of the Actuary, Defense Manpower Data Center. The resultant normal cost for officers and enlisted as a percentage of payroll was 46.2 percent in 1980, 47 percent in 1981 and 50.7 percent in 1982. Officers had a normal cost percentage of

38 percent of basic pay in 1980, 40 percent of basic pay in 1981, and 42 percent of basic pay in 1982. (DOD, 1980; DOD, 1981; DOD, September 1982)

The Defense Manpower Data Center in its valuation of the military retirement system uses the entry age normal method on the aggregate basis. In valuating the military retirement system, DMDC assumes that a funding scheme would be established and therefore past service cost is recognized along with normal cost and actuarial gains and losses with the gains/losses being added to the past service cost and amortized over a period of 40 years (See Appendix I for a summary of DMDC's computations). The method employed by DMDC can be adapted for use in determining the current year's cost of future retirement benefits without recognizing the past service cost by implementing the frozen initial liability method. Under this method, the past service cost at implementation of the plan remains constant throughout the life of the plan and therefore is not considered in calculating the current year's cost of future retirement benefits (Hicks, 1965).

In calculating the current year's accrued cost of the active force's retirement benefit, as was the case for the individual method, both normal cost and actuarial gains and losses are considered. Past service liability is not a factor. However, the normal cost is determined by applying the normal cost percentage factor to the current year's total basic pay of the active force. Actuarial gains/losses for the aggregate

basis are calculated in a similar manner as they were for the individual basis except that the computations are in the aggregate, i.e., the difference is taken between the aggregate normal cost under actual conditions and the aggregate normal cost under assumed conditions. Amortization of gains/losses that are accumulated under the aggregate basis are handled in basically the same manner as under the individual basis and as illustrated in Table II. The difference between amortization under the aggregate basis and amortization under the individual basis is the period over which the gains/losses are spread. For the aggregate basis gains/losses are spread over a reasonable period of time, normally 10 - 20 years, instead of the remaining work-life of the active force (Phoenix and Bosse, August 1967). The reason for this difference is that when dealing with the active force as a whole the assumption is made that the force has a perpetual work-life. In contrast, the work-life of an entrant under the individual basis can be measured. Therefore, a reasonable period of time is arbitrarily selected, 20 years in this case, for spreading the gains/losses of the active work force. The sum of the normal cost and the gains/losses applied to the current year is the current year's accrued cost of the active force's total future retirement benefit.

G. AGGREGATE BASIS METHOD

The method for using the entry age normal method on the aggregate basis is as follows:

1. Normal cost computation.

   a. Calculate the normal cost percentage factor, PF.

   $$PF = \frac{PBe}{PCe}$$

   where: PBe = present value of future benefits of new entrant group

   PCe = present value of future compensation of new entrant group

   b. Calculate the normal cost for the current year's active force.

   $$NC = PF \times TBP$$

   where: PF = normal cost percentage factor

   TBP = total basic pay for current year

2. Actuarial gains and losses computations.

   a. Calculate the actuarial gains/losses, F, by taking the difference between the normal cost under current conditions, NC, and the normal cost under actuarial assumptions, AC. (This presumes that the plan has been in use for more than one year. Actuarial gains and losses are not a factor in the initial year of implementation).

   $$F = NC - AC$$

   where: NC = normal cost under current conditions

   AC = normal cost under actuarial assumptions

3. Current year total retirement cost computation.

   a. Calculate the current year's portion of gains/losses applied, Fa. Under the aggregate basis gains and

losses are spread over a reasonable period of time, e.g., 20 years.

$$Fa = (F + Fd) \left[\frac{i}{1 - \left(\frac{1}{1 + i}\right)^{20}} \right]$$

where: F = current year's gains/losses

Fd = prior year's deferred gains/losses

i = annual discount rate

b. Calculate the current year's total retirement cost for the active force.

TRC = NC + Fa

where: NC = normal cost for the current year

Fa = gains/losses applied to current year

H. AGGREGATE BASIS EXAMPLE

The following example demonstrates the use of the aggregate basis methodology discussed in Section G. Hypothetical data (an approximation of 1982 actual data used by the Defense Manpower Data Center) is used to compute the total 1982 accrued retirement cost. The normal cost under assumed conditions is arbitrarily selected for purposes of demonstration of the aggregate method. This cost would normally be determined by using the actuarial assumptions of the previous year for computation of the cost.

1. Participant data and actuarial assumptions.

Dollars in Billions

Year of computation	1982
Total 1982 active force basic pay	$27.9

Salary scale increase	7.5%
Discount rate	10.0%
Present value of future benefits of new entrant group	\$4.2
Present value of future compensation of new entrant group	\$8.3
Normal cost under assumed conditions	\$13.0
Deferred gains and losses	\$3.2

2. 1982 normal cost computation.

   a. Calculate the normal cost percentage factor, PF.

$$PF = \frac{\$4.2}{\$8.3}$$

$$= 50.6\%$$

   b. Calculate the 1982 normal cost, NC, for the active force.

$$NC = 50.6\% \times \$27.9$$

$$= \$14.1$$

3. 1982 actuarial gains and losses

   a. Calculate the 1982 actuarial gains/losses, F.

$$F = \$14.1 - 13.0$$

$$= \$1.1$$

4. 1982 total retirement cost computation.

   a. Calculate the gains/losses applied, Fa, in 1982.

$$Fa = (1.1 + 3.2) \left[\frac{.1}{1 - \left(\frac{1}{1 + .1}\right)^{20}} \right]$$

$$= 4.3 \times .1175$$

$$= \$.5$$

b. Calculate the 1982 total retirement cost, TRC, for the active force.

TRC = \$14.1 + .5

= \$14.6

I. CHANGES IN AGGREGATE ACTUARIAL ASSUMPTIONS

Changes in one or more of the actuarial assumptions used in calculating the annual normal cost of the active military force on the aggregate basis have the same effect that the changes had on normal cost computations under the individual basis. Under the aggregate basis changes in the actuarial assumptions are reflected in either the total basic pay factor or the normal cost percentage factor. Changes in salary scale and size of the active force directly effect the total basic pay factor. Changes in each of the remaining actuarial assumptions -- interest rate, percent staying until retirement, percent retiring in a given pay grade, retired life expectations, and length of service -- have an effect on the normal cost percentage factor.

Table V has been prepared to show what the approximate effect that changes in total basic pay or normal cost percentage factor have on the current year's accrued retirement cost. As was the case for changes in the number of entrants under the individual basis, the normal cost under the aggregate basis changes in direct proportion with the change in total basic pay. For a 1 percent increase in total basic pay from \$27.9 billion to 28.2 billion, normal cost increases by about 1 percent.

TABLE V

Changes in Basic Pay & Percentage Factor

(Dollars in billions)

Basic pay change	Percent factor	Normal cost	Percent change
$27.9	50.7%	$14.1	
28.2	50.7	14.3	1.0%
28.7	50.7	14.6	2.0

Basic pay	Percent factor change	Normal cost	Percent change
$27.9	50.7%	$14.1	
27.9	51.2	14.3	1.0%
27.9	52.2	14.6	2.0

Changes in the percentage factor have a greater impact on normal cost than basic pay changes. An increase in the normal cost percentage factor from 51.2 percent to 52.2 percent results in the normal cost increasing by 2.0 percent. For each ½ percent increase in the percentage factor normal cost increases by approximately 1.0 percent.

Along with understanding how changes in total pay and the normal cost percentage factor effect the normal cost, it is important for the decision maker to understand how changes in the actuarial assumptions, which the decision maker has some control over, effect the total pay factor and the normal cost percentage factor. A brief discussion of each element follows:

1. Changes in salary scale. An increase in the rate at which annual basic pay increases has a direct effect on the total basic pay factor used in the normal cost calculation. For each percent that the salary scale increases, total basic pay also increases by that same percentage.

2. Change in the percent retiring. An increase in the percentage of people staying until retirement has the effect of increasing the normal cost percentage factor and in turn the annual accrued cost of the retirement benefits also increases. The normal cost percentage factor increases due to the fact that the present value of future benefits becomes larger due to more people receiving retired pay. The present value of future salaries also increases because basic pay is received for a longer period of time but the increase is usually not as great

as the benefits increase. Changes in the percent of people retiring in a given grade are effected in a similar manner.

3. Changes in the number of entrants. An increase in the number of entrants has a direct effect on the annual accrued cost of future retirement benefits. The total basic pay factor increases due to the larger number of recipients and the normal cost percentage factor does not change because the present value of future benefits and the present value of future salaries increase proportionately. As a result, the annual accrued cost of retirement benefits will increase.

4. Change in the length of service at retirement. With an increase in the length of time that a person serves before retiring, both total basic pay factor and the normal cost percentage factor will increase. With both factors increasing the resultant effect is that the accrued retirement cost will also increase. The increase in the total basic pay factor is caused by members receiving basic pay for a longer period of time. The increase in the normal percentage factor is caused by the present value of future benefits increasing more than the present value of future salaries. Increases in both benefits and salaries are a result of the longer length of service.

When considering what effect a change in an actuarial assumption might have on the annual cost of retirement benefits, the decision maker must look at the total impact that the change may have on all of the actuarial assumptions. As discussed

under the individual basis, a simple increase in salary scale may change the other assumptions discussed, i.e., percent retiring, number of entrants, length of service at retirement, and life expectations at retirement. For this reason it is extremely important that actuarial assumptions be continually evaluated and adjusted so that accurate cost estimations can be determined for accruing a portion of the cost of future retirement benefits to the current year.

J. AGGREGATE BASIS OR INDIVIDUAL BASIS

The aggregate basis and the individual basis when applied to an entry age normal actuarial method are generally the same. Both basis are used to determine the normal cost which is the level amount, which if paid annually over the entire period of recognized service, would provide at retirement the full retirement benefits. The basic difference between the two methods is that under the individual basis calculations of normal cost are made for individuals and under the aggregate basis, separate calculations of normal cost are not determined for individuals (Hicks, 1965).

In accessing which of the two basis is preferable, the intended use of the data must be considered. The aggregate basis lends itself to applications in which total force retirement costs are desired. The reason that this basis is useful for determining total force retirement costs is because it uses the cumulative data of the whole force instead of individual data in calculating the normal cost. By applying the normal

cost percentage factor to the total annual basic pay of the active force, total current year retirement costs can be determined. Areas for which the aggregate basis can be used are in budget forecasting and the actual accounting for the current year's accrued portion of the cost of the future retirement benefits of the active force. Each of these areas are concerned with the retirement cost of the total active force and therefore cumulative data instead of individual data can be used.

The individual basis can be used for calculating the accrued cost of retirement benefits for the active force as a whole, but it is more applicable to individual or entrant group calculations. This basis could be used by the decision maker who is concerned with altering a particular segment of the active force rather than the force as a whole. An example of this would be increasing the number of active members from a particular year group who will stay until retirement by providing incentive pays and bonuses. The effect of this change on retired costs could be determined by treating the year group as an "individual" and applying the changed actuarial assumptions to the year group as a whole in calculating the new normal cost and actuarial gains/losses. However, the decision maker must be careful to ensure that any effect that the change might have on other members of the active force are included in the new retirement cost computations.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This chapter provides a discussion on the conclusions and recommendations of this study. The purpose of the study was to evaluate alternative methods for accounting for the cost of military retirement benefits.

The present method for accounting for the cost of military retirement benefits is the pay-as-you-go basis. The problem with the pay-as-you-go basis is that it puts off recognizing the cost of the retirement benefits of the current active force until the time those participants actually retire. In doing so, the cost of the current force is underestimated.

For the decision maker to fully understand the total cost of manpower decisions relating to force structure, an accurate assessment of the retirement cost implications of policy alternatives must be included. The method for recognizing these costs is through allocation of the cost of future retirement benefits by accrual basis accounting. Accrual basis accounting is presently being used in a portion of the military's accounting system and the Congressional Budget Office and General Accounting Office are advocating a switch to accrual basis accounting for the military retirement system. In light of this, the emphasis of this study was placed on evaluating the methods for allocating the cost of future retirement payments

to the period in which the obligations are incurred instead of the period in which they may be paid.

The currently accepted method for allocating retirement costs under accrual basis accounting is through the use of actuarial cost methods. In order to accurately predict the cost of future retirement benefits numerous assumptions about the future must be made. The actuarial assumptions used include: estimated interest rates, expected future compensation levels, the expected mortality rate, estimates of the number of people who will stay until reaching retirement age, and length of service at time of retirement. Without accurate and on-going actuarial computations, the allocation of retirement costs under accural basis accounting become imprecise.

Hicks (1965) in Accounting Research Study No. 8 recognizes the following actuarial cost methods for use in accrual accounting of retirement costs; the unit credit cost method, the entry age normal method, the individual level premium method, the aggregate method and the attained age normal method. The most often used method for accounting for the cost of private pension plans is the entry age normal method.

Most of the actuarial cost methods have been designed primarily as funding techniques but they also may be used in allocating costs for accounting purposes. As demonstrated in Chapter V the entry age normal method is the actuarial cost method that is the most appropriate for accounting for the cost of future retirement benefits of the active force. This method

spreads the cost of retirement benefits over the active work-life of service members in the form of level annual allocations of the cost. This method of allocation facilitates the identification of the total current year's cost of military personnel for the decision maker.

Two bases of applying the entry age normal method are recognized, the individual basis and the aggregate basis. Either of these basis are exceptable methods for calculating the cost of future retirement benefits. In utilizing either the individual basis or the aggregate basis, the accuracy of the actuarial assumptions used plays an important role in the accuracy of retirement cost computations. For this reason actuarial assumptions must be up-dated on a continuing basis to ensure that accurate information is available for retirement cost computations.

B. RECOMMENDATIONS

The following recommendations are made:

Recommendation One: Accrual basis accounting should be adopted for recognizing the cost of military retirement benefits. This accounting basis would better enable the decision maker to understand the total current year's cost of the active military force.

Recommendation Two: An actuarial cost method should be selected for allocating costs under accrual basis accounting. A method similar to the entry age normal, individual basis or aggregate basis, discussed in Chapter V could be used.

APPENDIX A

DMC FY 1981 VALUATION OF THE MILITARY RETIREMENT SYSTEM

Appendix A is an excerpt of pages 1 to 20 of DMDC's FY 1981 Valuation of the Military Retirement System.

INTRODUCTION

This documentation summarizes the formal actuarial valuation of the military retirement system as of 30 September 1981. Public Law 95-595 required all federal pension systems to adhere to the reporting requirements of the Employee Retirement Income Security Act (ERISA). All figures included in the fiscal year 1981 report were taken from this valuation and are based on sound actuarial principles. The military retirement system is not an old-age pension system normally found in the private sector and subject to the provisions of ERISA. Rather, it is a system specifically designed to complement the management of the active force, and is a function of the military pay and allowance compensation structure. Notwithstanding these differentiations in design and purpose, the Department of Defense adheres to the reporting requirements of ERISA for the purpose of this report.

The military retirement system is really three separate but interrelated defined benefit systems: a nondisability system for retirements from the active service, a nondisability system for retirements from the reserves, and a disability retirement system. All three components are unfunded, non-contributory, and annually increased for inflation after retirement. Additionally, provision is made for optional survivor coverage. Military members are not retired in the traditional sense of the term; they retain military status, are subject to the Uniformed Code of Military Justice, and are subject to recall to active duty.

Currently, the Service Secretaries approve voluntary nondisability retirement upon credit of at least 20 years of service at any age. The retiree from active service receives an immediate annuity calculated as 2½% of base pay for each year of creditable service, subject to a maximum of 75% of base pay. Base pay is equal to final basic pay if the retiree first became a member of the Armed Services before 8 September 1980. For those new members after that date, base pay equals the average of the highest 36 months of pay. A member has no vested right in the retirement system.

SUMMARY

On 30 September 1981, there were 2.1 million active duty regular and reserve personnel, .9 million selected drill reservists, 1.1 million retired nondisability annuitants, .15 million disability annuitants, and 73 thousand survivor benefit families in the military retirement system. Fiscal year 1981 retired appropriation outlays totaled $13.7 billion. The most common age at retirement from active duty is 43 for officers and 39 for enlistees. Excluding reserve retirees, in September of 1981 the average gross monthly annuity for all nondisabled officers was $1,751 and nondisabled enlistees averaged $761 a month.

Valuation results show an aggregate entry-age normal cost of 47.0% of basic pay. This means that for an entering cohort of servicemen, continuously placing 47% of their basic pay in a fund would be sufficient to pay for future retirement and survivor benefits of those who eventually qualify for these benefits. The cost of the present pay-as-you-go method will ultimately level out at 56% of basic pay. All liabilities relate to the Department of Defense retired pay appropriation only.

As of September 30, 1981 the entry-age normal cost unfunded liability is $477 billion. This represents the size of the fund needed to pay for all future retired and survivor benefits, assuming future continuous payments totaling 47.0% of basic pay are added to the fund. The present value of accumulated plan benefits for services that have already been rendered is $378 billion.

Basic pay, or base pay, is the only element of military compensation upon which military retired pay is computed. This is the principle element of military compensation which all members receive; but it is not representative, for comparative purposes, to salary levels in the private or public sectors. Reasonable comparisons can be made, however, to Basic Military Compensation (BMC). This is the base level of compensation received by members and is the sum of basic pay, the quarters allowance (either cash or in kind), a subsistence allowance (either cash or in kind), and the federal tax advantage accruing to allowances since they are not subject to federal income tax. Consequently, comparisons of military retired pay to other pension systems must recognize the relationship to BMC rather to basic pay only.

FUNDING METHOD

Prior to 1935, the Navy had a pension fund (on a nonactuarial basis) which provided for payments to persons retired

for disability whenever there was a sufficient amount in the fund. Other retired pay was paid directly from appropriations, and when the fund was insufficient, the disability retired pay was also paid from appropriations. The income to the fund consisted of the government's share of the proceeds from the sale of enemy or pirate ships captured by the Navy, and from interest received on fund investments. This fund was abolished in 1935, and since that time the military retirement system has been entirely on an unfunded or 'pay-as-you-go' basis. This valuation will show the unfunded liability under this funding method, which is just the present value of future benefits, as well as the unfunded liability under an aggregate entry-age normal cost funding method.

VALUATION DATA AND PROCEDURE

The valuation input data was abstracted from files maintained at the Defense Manpower Data Center (DMDC). Retiree and survivor data came from official files submitted by the Service Finance Centers (Army, Navy, Marines, and Air Force) quarterly. Reserve data was obtained from the Reserve Component Common Personnel Data System (RCCPDS), the official source for all Reserve strengths and statistics. Active duty data came from files provided quarterly by the four military personnel centers.

The files were aggregated and edited, disregarding invalid data. Detailed comptroller totals were used on all specific areas of data to bring the numbers and dollar amounts on the edited file up to actual size. The blow-up figure was less than .5% for retirees and .1% for active duty personnel. The only area that could not be matched to official DOD figures is the number of surviving families. This will be resolved in the future. The total of the survivor annuities was matched to actual payments.

Dollar amounts included the 1 October pay raise for active duty and reserve personnel. These totals are summarized in Table I.

The seriatim method was used in all phases of the valuation including active, retired, and survivor segments. A model incorporates all parts of the military retirement system, including the drill reservists. This captures future liabilities for those members who leave active duty and later join the reserves to retain past retirement credits.

An aggregate entry-age normal cost percentage was developed by dividing the present value of future benefits by the present value of future salaries of a new entrant group

TABLE I

Initial Accounting Figures as of 30 September 1981

($ in billions - basic pay includes October 1st raise)

Total Active Duty Personnel + Full Time Active Duty Reservists	2,087,692
Total Annualized Basic Pay	$25.6
Total Selected Drill Reservists	880,035
Total Annualized Basic Pay	$ 2.0
Total Number of Nondisability Retirees	1,143,248
Total Annualized Retired Pay	$12.5
Total Number of Disability Retirees	145,714
Total Annualized Retired Pay	$ 1.3
Total Number of Surviving Families	73,022
Total Annualized Survivor Annuities	$ .4

TABLE II

Normal Cost Analysis and Detail

(as Percent of Basic Pay)

Nondisability Benefits	43
Disability Benefits	3
Survivor Benefits	1
Total Force	47%

starting their careers on the valuation data. New entrants models were created for drill reservists and active duty personnel using FY80 experience. The models are essentially arrays indicating what percentage of people enter at each age and category. Since there were two separate models, the relative size of the number of new entrants used in each category was carefully set.

The unfunded liability was defined as the present value of future benefits minus the present value of future normal costs for all those currently in the system. This includes present active duty personnel, drill reservists, retirees, and survivors, as well as future retirees and future survivors resulting from this group.

ECONOMIC AND OTHER ACTUARIAL ASSUMPTIONS

The present values shown herein have been determined using a 5% rate of inflation assumption set by the Office of Management and Budget. The other economic assumptions, 5.5% for general salary scale increases (not including merit and promotion) and 6% for investment return were selected to be consistent with the 0.5% and 1.0% differentials used by the Board of Actuaries of the Civil Service Retirement System. The Board's differentials were based on a study of real salary growth for Federal employees and real earnings of Federal securities. The long term nature of pension liabilities caused the Board to hesitate to overreact to current high market yields. The 1950 to 1978 experience was used to moderate the effect of typical short-term trends. Future military salary scale increases and the theorectical return on investments of a military retirement fund will be similar to the experience of the Civil Service System. Since the military retirement system is fully indexed, the liabilities vary only slightly for sets of economic assumptions with the same differentials.

Military specific death and decrement rates were created in 1980 using current experience. The rate creation process was discussed and the rates were published in the FY80 Valuation of the Military Retirement System which is available on request. An actual/expected study will be made annually starting with preparation for the FY82 Valuation.

VALUATION RESULTS

Table II summarizes the normal cost findings. The normal cost as a percent of basic pay for the system as a whole is 47%. Separately, officers have a normal cost of 67% and enlistees 40% of basic pay. These figures contain active

duty as well as selected drill reservists in the basic pay figures. The retired pay figures include reserve and active duty retirees as do the surviving family annuities. The detailed projections indicated that for a group of new entrants into the military, 12% become eligible for nondisability retirement. 35% of new officers and 11% of new enlisteds attain 20 years of service.

Table III summarizes the total present value of future pay and benefits of $590.4 billion as well as the entry-age normal cost unfunded liability of $476.9 billion. If an accrual accounting system had been installed as of 30 September 1981, whereby the normal cost would be placed in a fund annually, the fund would also need this $476.9 billion lump sum payment to pay future benefits. An amortization schedule would be set up to make payments on the $476.9 billion over 40 or more years.

One measure of the funding of a retirement system is the value of benefits earned to the date of the valuation. As shown in Table IV, the present value of accumulated plan benefits as of 30 September 1981 was $377.8 billion.

Accumulated plan benefits are those future periodic payments that are attributable, under the Plan's provisions, to the service that military personnel have rendered. Accumulated plan benefits include benefits expected to be paid to (a) retired military or their beneficiaries, (b) current beneficiaries, (c) present active duty personnel and nonretired reservists or their beneficiaries. Benefits payable under all circumstances (retirement, Disability, and survivor) are included to the extent they are deemed attributable to service rendered prior to the valuation date. No future salary increases are used but annuities are increased in line with the post-retirement inflation provision.

The actuarial present value of accumulated plan benefits is that amount that results from applying actuarial assumptions to adjust the accumulated plan benefits to reflect the time value of money (through discounts for interest) and the probability of payment (by means of decrements such as for death, disability, withdrawal, or retirement) between the valuation date and the expected date of payment. The actuarial assumptions are based on the presumption that the Plan will continue. Were the Plan to terminate, different actuarial assumptions and other factors might be applicable in determining the actuarial present value of accumulated plan benefits. Table IV summarizes these benefits.

TABLE III

Actuarial Liability

($ in billions)

PRESENT VALUE OF FUTURE BASE PAY	Sept 30, 1981
Active Duty:	
Regular Officers	$ 65.2
Nonregular Officers	19.7
Regular Enlisteds	134.9
Nonregular Enlisteds	3.9
Active Duty Subtotal	$223.7
Selected Reservists:	
Officers	5.3
Enlisteds	12.5
Selected Reservists Subtotal	$ 17.8
Total Present Value of Future Basic Pay	$241.5
PRESENT VALUE OF FUTURE BENEFITS	
Current and Future Retirees:	
Nondisabled Officers	242.1
Nondisabled Enlisteds	286.2
Disabled Officers	15.9
Disabled Enlisteds	17.9
Retiree Subtotal	$562.1
Current and Future Surviving Families:	
Surviving Families	$ 28.3
Total Present Value of Future Benefits	$590.4
Normal Cost %	47.0
Pay-As-You-Go Liability	$590.4
Present Value of Future Normal Costs	$113.5
Entry-Age-Normal Cost Liability	$476.9
Fund Balance	0.0
Pay-As-You-Go Unfunded Liability	$590.4
Entry-Age-Normal Cost Unfunded Liability	$476.9

TABLE IV

Accumulated Plan Benefits

($ in billions)

PRESENT VALUE OF FUTURE BENEFITS	September 30, 1981
Current and Future Retirees:	
Nondisabled Officers	$152.9
Nondisabled Enlisteds	177.0
Disabled Officers	13.1
Disabled Enlisteds	12.2
Retiree Subtotal	$355.2
Current and Future Surviving Families	
SBP	*20.8
Reserve SBP	.3
Minimum Income	.1
DIC	.3
RSFPP	1.1
Surviving Families Subtotal	$ 22.6
Total Present Value of Future Benefits	$377.8
PRESENT VALUE OF VESTED AND NONVESTED BENEFITS**	
Participants Currently Receiving Payments	$273.7
Other Vested Participants	54.4
Vested Benefits Subtotal	$328.1
Non-Vested Benefits	$ 49.7
Total Present Value of Future Benefits	$377.8

*The decrease in accumulated liability for SBP was primarily due to an increase in Veterans Administration Offset assumptions for survivor annuities.

**Military members are not vested in the military retirement system. For the purpose of this chart only, a nonretired vested participant is defined as an active duty member with over 20 years of service creditable toward retirement.

GAIN AND LOSS

A formal gain and loss analysis program has not yet been developed for the military retirement system, so extensive examinations of the changes were made to verify results.

There were three major changes in compensation that affected the FY81 valuation. The first was a change to once-a-year cost-of-living increases for retirees instead of twice-a-year. Secondly, in the calculation of service for retired pay purposes, part of a year that is less than six months is disregarded and part of a year that is six months or more is rounded down to the nearest whole month actually served. Prior procedure required six months or greater service to be rounded up to the next full year. The third change was a direct result of the variable basic pay increase given to enlisted personnel on October 1, 1981. This action increased the internal or promotion valuation salary rates of enlisted members.

Only one other major actuarial assumption change had a significant impact on normal cost results. Veterans Administration (VA) offset amounts were lowered for retired pay and increased for survivor annuities. These changed due to their direct relationship with cost-of-living increases as well as a different technique of creating the ratios. A more detailed analysis of VA interaction will be made prior to the FY82 valuation. Table V analyzes the impact of the above changes on the normal cost percentage.

TABLE V

Analysis of Change in Normal Cost Percentage

FY80 Normal Cost Percentage	46.2
Changes:	
Once-a-year cost-of-living increases	(.5)
Rounding of service	(.2)
Variable enlisted basic pay increases	.4
VA offset changes	1.1
Net change	.8
FY81 Normal Cost Percentage	47.0

Two other actuarial assumption changes were made that had insignificant impacts on normal cost, but that affected the accumulated plan benefits as well as the present value of future benefits for the plan participants. Both of these

assumption changes were the result of fine-tuning reserve retirement projections. The number of members reentering service by transferring from active duty to reserve duty increased as well as the number of reserve retirements from a non-pay status.

Table VI analyzes the change in accumulated plan benefits from September 1980 to September 1981.

TABLE VI

Statement of Changes in Accumulated Plan Benefits

($ in billions)

I. Actuarial present value of accumulated plan benefits on September 30, 1980		$348.9
II. Increases (decreases) during the year attributed to:		
A. Actuarial Assumptions		$ 5.6
* Increase in career salary rates	$ .7	
VA offset changes	1.1	
Reserve reentrant	.9	
Reserve retirements for non-pay status	2.9	
B. Plan Changes		$ (4.4)
Rounding of Service	$(.7)	
Once-a-year Cost-of-Living	(3.7)	
C. Benefits Accumulated and Actuarial Gain or Loss		$ 27.7
III. Actuarial present value of accumulated plan benefits on September 30, 1981		$377.8

* Direct impact of variable pay increase for enlisteds in October 1981.

The $27.7 billion associated with the increase in accumulated plan benefits due to the FY81 accumulation and actuarial gain and loss was derived by balancing the equation on Table VI. The following independent analysis shows that it is close to the total that would have been produced had we had a formal gain and loss program. The monthly total basic pay increased

17.4% between October 1980 and October 1981 due to changes in force size structure and the October 1980 basic pay rise. This pay rise was 14.3% for officers but varied for enlisted. Enlisted increases ranged from 10% at the lower ranks to 17% at the higher ranks. Higher rank increases have the most impact on retired pay since nondisability retirees are at those ranks when they retire. The monthly total retired pay increased 5.8% during this period. This was a result of the March 1981 cost-of-living increase of 4.4% and the growth in the retired population.

The actuarial present value of benefits in retired and survivor pay status was $261.6 billion on September 30, 1980. Multiplying this by the 5.8% gives us an increase of $14.9 billion. Likewise, the active duty future liabilities of $45.6 and $41.7 can be increased by the 17.4%. These figures all total $30.1. Analysis indicated that the average age of the retired population went up during FY81. Consequently, the hypothetical $14.9 billion increase in retired liability mentioned above should be lowered. This adjustment would place the $30.1 billion closer to the $27.7 figure obtained by balancing. Many other variables affect gain and loss, but without an analysis program the pieces cannot be individually analyzed. DOD plans to build this type of program for future use. Table VII analyzes the change in the present value of future benefits from September 1980 to September 1981. Just as discussed in the prior section on accumulated plan benefits, it can be shown that the $58.0 billion increase in the pay-as-you-go unfunded liability in line II.C resulted mainly from increases in active duty and retired retainer pay and population size in FY81.

LONG-TERM ANALYSIS

Assuming a level active duty force, total basic pay and retired appropriation outlays are projected 75 years into the future in Table VIII. The figures are placed into perspective by the outlays over pay ratios. It should be noted that this ratio peaks at 64% in the year 2000 and then drops to 56% in 2032 where it remains level. This ultimate 56% should be compared to the ultimate 47% under a funded entry-age normal cost method. A good argument for remaining unfunded could be made with only a 9% difference in ultimate budget outlays. The economic assumptions used in the projection are indicated on the bottom of Table VIII. Short-term assumptions were smoothed into long-term assumptions after 5 years.

TABLE VII

Changes in Present Value of Future Benefits

($ in billions)

I. Actuarial present value of future plan benefits on Sept. 30, 1980		$523.3
II. Increases (decreases) during the year attributed to:		
A. Actuarial Assumptions		$ 15.4
*Increase in career salary rates	$2.7	
VA offset changes	3.4	
Reserve reentrants	3.5	
Reserve retirements for non-pay status	5.8	
B. Plan Changes		$ (6.3)
Rounding of Service	$(.8)	
Once-a-year cost-of-living	(5.5)	
C. Benefits Accumulated and Actuarial Gain or Loss		$ 58.0
III. Actuarial present value of future plan benefits on Sept. 30, 1981		$590.4

*Direct impact of variable pay increase for enlisteds in October 1981.

TABLE VIII

Military Retirement System

Total Past and Projected Basic Pay and Retired Appropriations Outlays ($ in billions)

Fiscal Year	Total Basic Pay	Total Retired Appropriation Outlays	Retired Outlays/ Basic Pay Outlays
1980	$ 20.9	$ 11.9	.57
1981	23.5	13.7	.58
*1982	27.6	15.1	.55
1983	29.7	16.6	.56
1984	32.0	17.9	.56
1985	33.8	19.2	.57
1986	35.7	20.5	.57
1987	37.7	21.8	.58
1988	39.8	23.2	.58
1989	42.0	24.8	.59
1990	44.3	26.4	.60
1991	46.8	28.1	.60
1992	49.4	30.0	.61
1993	52.1	31.8	.61
1994	55.0	33.8	.62
1995	58.0	35.9	.62
1996	61.2	38.0	.62
1997	64.5	40.4	.63
1998	67.9	42.8	.63
1999	71.5	45.3	.63
2000	75.3	48.0	.64
2001	79.4	50.7	.64
2006	103.4	65.7	.64
2011	135.0	83.9	.62
2016	176.6	106.2	.60
2021	230.8	135.1	.59
2026	301.7	173.1	.57
2031	394.2	223.1	.57
2036	515.2	288.8	.56
2041	673.3	375.5	.56
2046	880.0	489.8	.56
2051	1150.2	640.2	.56
2056	1503.3	837.3	.56

*Projected from this year on.

ACCRUAL ACCOUNTING

The Department of Defense is sponsoring a legislative proposal that would essentially place the military retirement system on an entry-age normal cost funding method. The proposal calls for the normal cost, as well as a payment on the unfunded liability, to be placed into a fund each year. These combined payments are referred to as the "retired pay cost". The method and length of amortization is not precisely defined.

Under an entry-age normal method, when salaries are assumed to increase, the normal cost is defined not as a level dollar amount payable each year, but as a level percentage of salary or the compensation item upon which pensions are based. This spreads the payments out so that the financial impact is a uniform percentage of salary in all years. Since the military compensation system is one of pay and allowances rather than a salary, basic pay is the compensation item used to determine costs of the military retirement system. Likewise, using level dollar amortization of the unfunded liability when annuities are tied to CPI and salary increases creates an early year financial burden and misunderstandings of the true cost of the system. Amortization of the unfunded liability as a level percent of basic pay is a more defensible approach. Table IX shows the accrual cost associated with the normal cost of 47% and the unfunded liability of $476.9 billion for three different amortization periods, all as a level percent of basic pay. The Fiscal year 1982 costs range from $21 to $26 billion or $6 to $11 billion more than the current cost.

If the unfunded liability had been amortized over 40 years in equal dollar payments, the level annual payment would be $29.9 billion. This would have resulted in a total 1982 accrual cost of $42.9 billion or $27.8 billion over the actual outlays of $15.1 billion. This level of funding is not only unnecessary but misleading since the cost would drop rapidly to 47% of basic pay. Table X shows the cost of retirement as a percent of basic pay under three scenarios; retired pay costs with 40 year level amortization, retired pay costs with 40 year amortization as a level percent of basic pay, and the present pay-as-you-go unfunded method. Column two varies slightly in the early years, since variable annual basic pay scale assumptions were used in the projection for the first five years, and level assumptions were used in amortization.

In the private sector the question of funding is simply one of recognizing that the true cost of a pension plan must be paid during the working lifetimes of the employees who will ultimately receive the benefit. Likewise, on the surface it would appear that the question of funding the military retirement system is simply one of allocating tax monies to a fund from a designated generation of taxpayers. Today, allocation of costs among taxpayers is complicated by the fact that such a fund would be a part of the Unified Budget of the Federal government and payments into the fund from

TABLE IX

Military Retirement Appropriation Accrual Costs

($ in billions)

40 Year Amortization as % of Basic Pay Scale Increases

FY	Est* Basic Pay	Normal Cost	Payment on Unfunded	Total Accrual Cost	Total Est Outlays	Added Cost of Accrual
82	$ 27.6	$ 13.0	$ 13.1	$ 26.1	$ 15.1	$ 11.0
83	29.7	14.0	13.8	27.8	16.6	11.2
84	32.0	15.0	14.6	29.6	17.9	11.7
85	33.8	15.9	15.4	31.3	19.2	12.1
86	35.7	16.8	16.3	33.1	20.5	12.6
87	37.7	17.7	17.1	34.8	21.8	13.0

60 Year Amortization as % of Basic Pay Scale Increases

FY	Est* Basic Pay	Normal Cost	Payment on Unfunded	Total Accrual Cost	Total Est Outlays	Added Cost of Accrual
82	$ 27.6	$ 13.0	$ 9.2	$ 22.2	$ 15.1	$ 7.1
83	29.7	14.0	9.7	23.7	16.6	7.1
84	32.0	15.0	10.2	25.2	17.9	7.3
85	33.8	15.9	10.8	26.7	19.2	7.5
86	35.7	16.8	11.4	28.2	20.5	7.7
87	37.7	17.7	12.0	29.7	21.8	7.9

75 Year Amortization as % of Basic Pay Scale Increases

FY	Est* Basic Pay	Normal Cost	Payment on Unfunded	Total Accrual Cost	Total Est Outlays	Added Cost of Accrual
82	$ 27.6	$ 13.0	$ 7.6	$ 20.6	$ 15.1	$ 5.5
83	29.7	14.0	8.0	22.0	16.6	5.4
84	32.0	15.0	8.5	23.5	17.9	5.6
85	33.8	15.9	8.9	24.8	19.2	5.6
86	35.7	16.8	9.4	26.2	20.5	5.7
87	37.7	17.7	9.9	27.6	21.8	5.8

*Includes basic pay to active duty and selected reserves.

Unfunded Liability = $476.9 billion
Normal Cost % = 47.0

TABLE X

Total Retired Pay Costs as a Percent of Basic Pay

FY	Cost With 40 Year Level Amortization	Cost With 40 Year Level % of Basic Pay Amortization	Present Pay-As-You-Go Cost
1982	155%	95%	55%
1983	148	94	56
1984	140	93	56
1985	136	93	57
1986	131	93	57
1991	111	92	60
1996	96	92	62
2001	85	93	64
2206	76	93	64
2011	69	93	62
2016	64	93	60
2021	60	92	59
2026	47	47	57
2031	47	47	57
2036	47	47	56

general revenues or agencies are intergovernmental transfers with no impact on the Federal surplus or deficit. Since taxes are set, at least in theory, relative to a certain desired level of surplus or deficit, and since retirement fund transfers would not affect this amount, current taxes would not be affected by additional payments from general revenues to a military retirement system fund.

The added cost of accrual accounting in any year would be a general revenue expenditure but, at the same time, it would be retirement fund income. The two transactions would cancel each other out with no effect on the deficit. To complete the circle, the Treasury would increase the amount of bonds to meet this extra cost and the fund would purchase bonds of equivalent value. The total privately-held debt would not change. However, the total debt would increase and this might require increasing the statutory borrowing authority.

As described above, the Unified Budget deficit is not impacted by accrual of retirement costs and, therefore, accrual accounting will not reallocate costs among generations of taxpayers. However, an aggregate entry-age normal cost method of funding would have some advantageous aspects. Costs or savings of long-range changes to the system would appear immediately in the Department of Defense budget. From DOD's point of view, the true cost of the military retirement system would be paid during the active duty service of members, assuming the fund was kept outside the Department of Defense budget.

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